Bounds on Elasticities with Optimization Frictions: A Synthesis of Micro and Macro Evidence on Labor Supply

Raj Chetty

Harvard University and NBER

September 2011

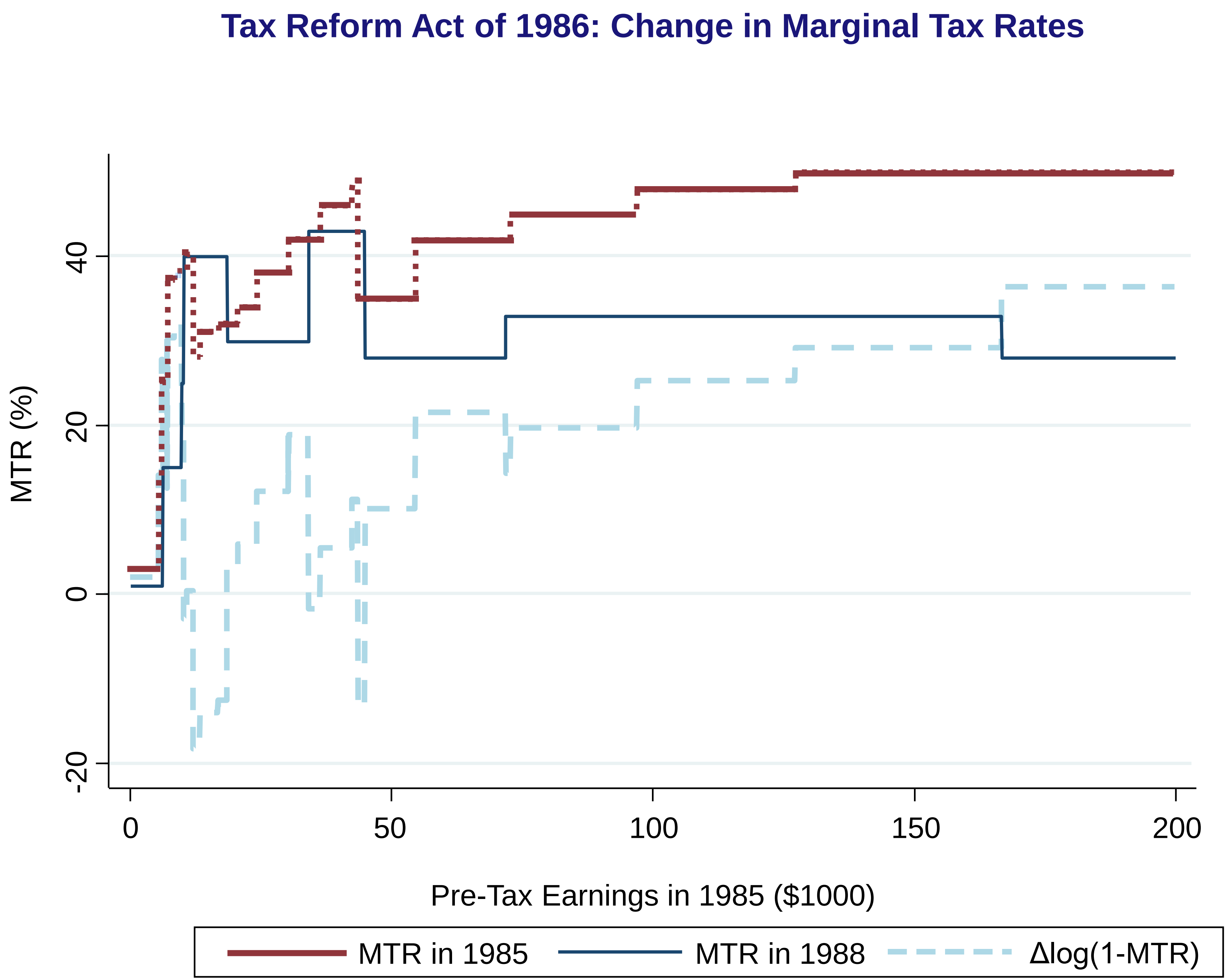
Introduction

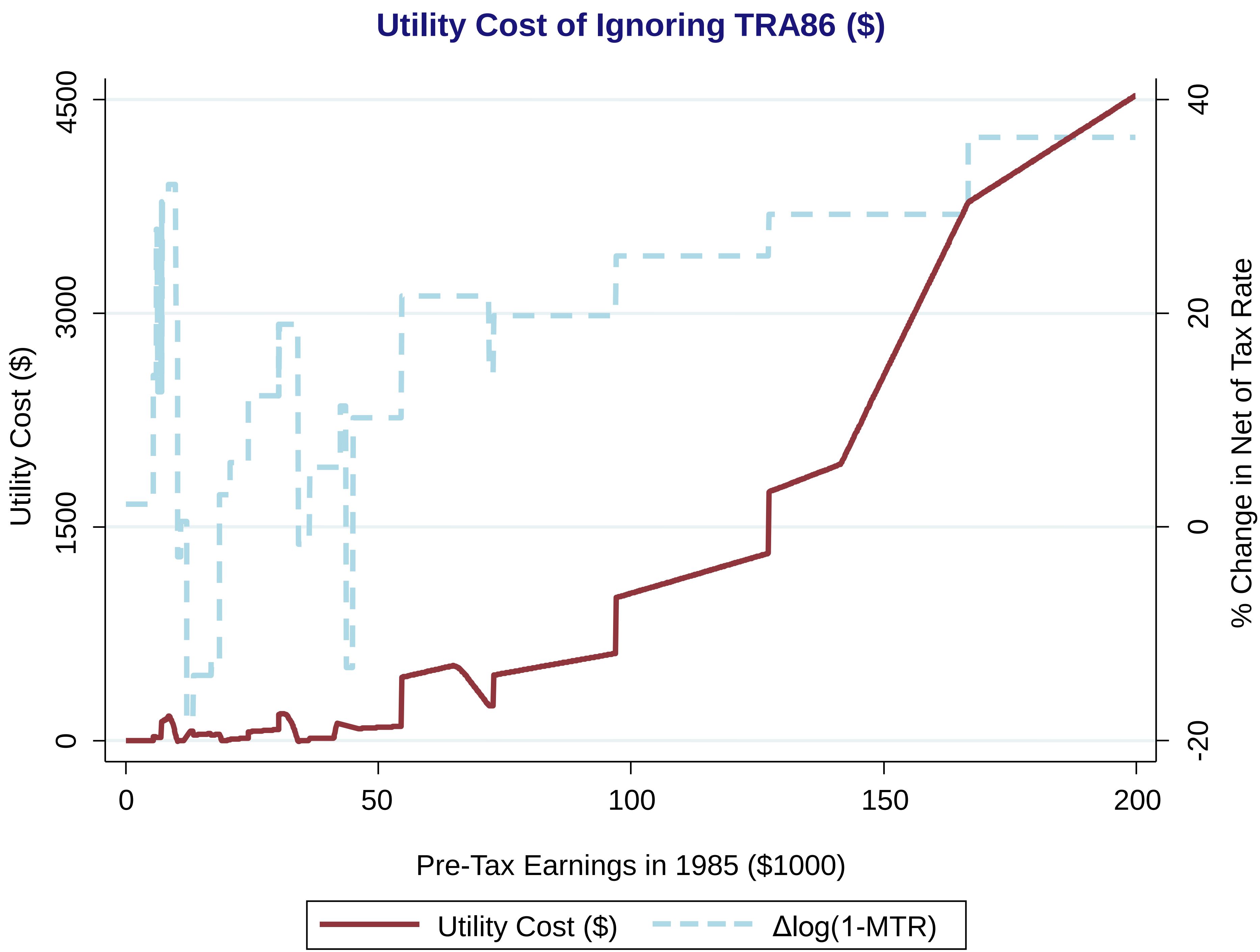
- Standard approach to identifying labor supply elasticities: estimate the effect of tax or wage changes on hours or earnings

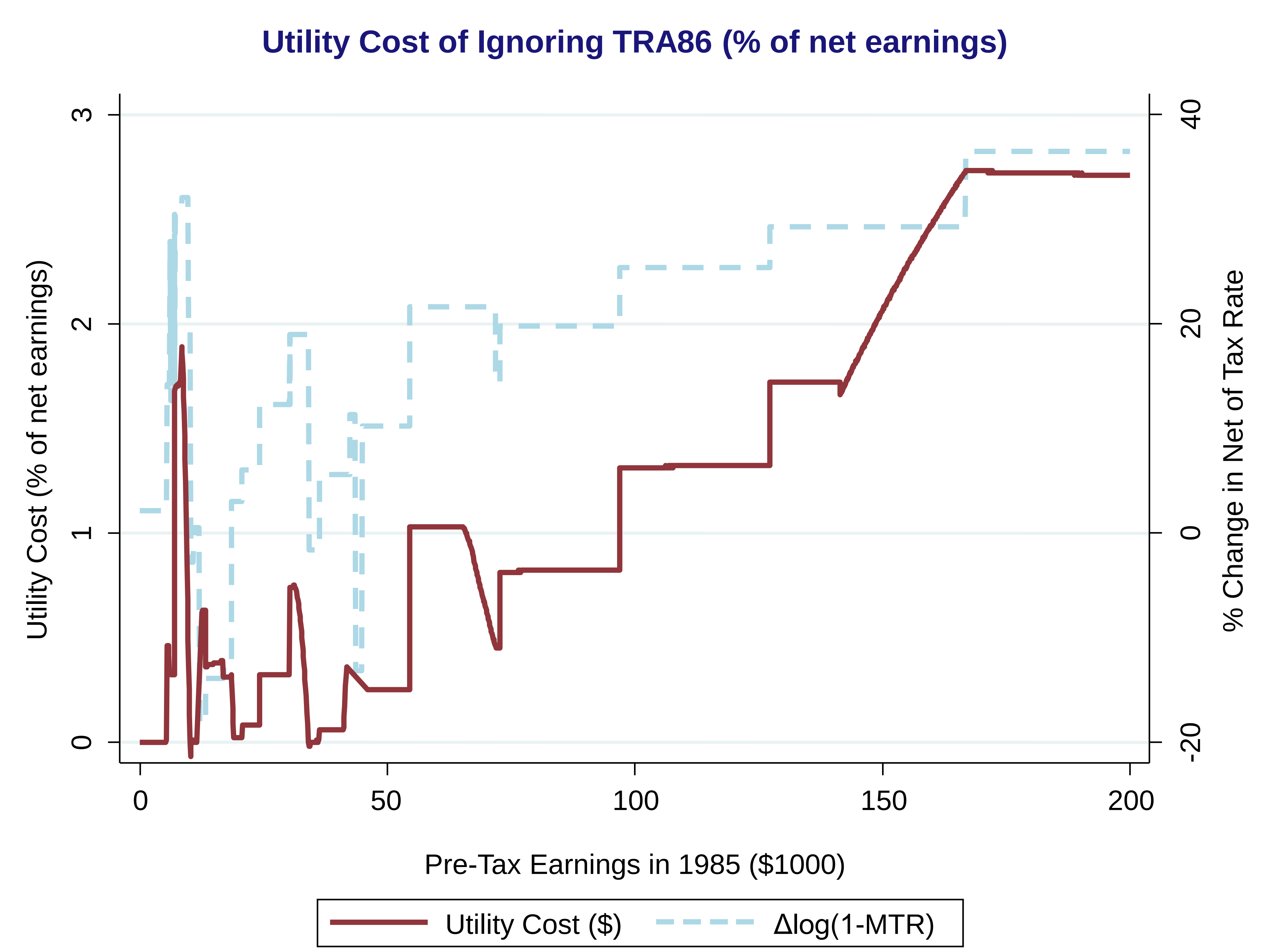
- But agents face optimization frictions that may affect observed responses
  - Search costs to switch jobs, costs of paying attention to tax reforms

- Even small frictions can substantially affect observed responses
  - Example: Tax Reform Act of 1986
  - Calculate annual utility loss from **ignoring** tax change in neoclassical model with elasticity $\varepsilon = 0.5$ and quasilinear flow utility

$$v_{i,t}(c_t, l_t) = c_t - a_i \frac{l_t^{1+1/\varepsilon}}{1+1/\varepsilon}$$


Tax Reform Act of 1986: Change in Marginal Tax Rates
MTR (%)
-20
0
20
40
0
50
100
150
200
Pre-Tax Earnings in 1985 ($1000)
MTR in 1985
MTR in 1988
Δlog(1-MTR)


Utility Cost of Ignoring TRA86 ($)
Utility Cost ($)
% Change in Net of Tax Rate
0
1500
3000
4500
-20
0
20
40
0
50
100
150
200
Pre-Tax Earnings in 1985 ($1000)
Utility Cost ($)
Δlog(1-MTR)



Utility Cost of Ignoring TRA86 (% of net earnings)
Utility Cost (% of net earnings)
% Change in Net of Tax Rate
Pre-Tax Earnings in 1985 ($1000)
0
1
2
3
-20
0
20
40
0
50
100
150
200
Utility Cost ($)
Δlog(1-MTR)

Optimization Frictions

- Observed response confounds preference parameter ε with frictions
    - Small observed earnings response to tax change could reflect large underlying elasticity + high adj costs

- Goal of this paper: identify "structural" elasticity ε from estimates of observed responses in an environment with frictions

- Why identify ε rather than just measuring observed response?
    - Positive analysis: calibration of models to predict counterfactuals
        - Ex: impacts of steady-state variation in taxes across countries
    - Normative analysis: calculating welfare costs requires recovering utility

Two Approaches to Addressing Optimization Frictions

Strategy 1: Estimate augmented model with frictions

- Hard to incorporate all frictions into a tractable model
- Difficult to estimate even stylized dynamic (e.g. Ss) models with frictions (Attanasio 2000)

Strategy 2: Accept model uncertainty due to optimization frictions and derive **bounds** on ε

Outline

1. Dynamic Demand Model with Frictions

2. Bounds on Price Elasticities

3. Application to Labor Supply

    - Synthesis of evidence: intensive vs. extensive, micro vs. macro

    - Bounds on structural labor supply elasticities

Related Literatures

1. Partial Identification [Manski 1993, Chernozhukov, Hong, Tamer 2007]
2. Robust Control [Hansen and Sargent 2007]
3. Near Rationality [Mankiw 1985, Akerlof and Yellen 1985, Cochrane 1989]
4. Durable Goods [Caballero et al. 1995, Attanasio 2000]
5. Micro vs. Macro Elasticities [Rogerson 1988, Keane and Rogerson 2010]

Frictionless Demand Model

- Standard lifecycle model
- N agents with heterogeneous preferences over two goods (x, y)
- Price of $y = 1$, $p_t =$ price of x in period t
- In talk, price path p_t is deterministic; paper permits stochastic process
- Individual i has wealth Z_i and chooses demand by solving

$$\max_{x_t, y_t} \sum_{t=1}^{T} v_{i,t}(x_t, y_t) \text{ s.t. } \sum_{t=1}^{T} [p_t x_t + y_t] = Z_i$$

Quasilinear Utility

- To simplify exposition in the talk, I use the following utility specification:

$$v_{i,t}(x_t, y_t) = y_t + a_{i,t} \frac{x_t^{1-1/\varepsilon}}{1-1/\varepsilon}$$

  - Quasilinear → money metric
  - Generates a constant price elasticity ε
  - Elasticity ε = Marshallian = Hicksian = Frisch elasticity

- Paper establishes results for general flow utility function by using expenditure functions to obtain a money metric
  - All results and bounds that follow apply to **Hicksian** elasticity in the general case

Identification in the Frictionless Demand Model

- With qlinear utility, agent i's optimal demand for good x in period t:

$$\log x^*_{i,t}(p_t) = \alpha - \varepsilon \log p_t + \nu_{i,t}$$

where ν_{it} denotes i's deviation from mean (log) demand

- Consider identification of ε using a price increase from p_A to p_B
- Identification assumption: taste shocks orthogonal to price change:

$$\mathbb{E}\nu_{i,A} = \mathbb{E}\nu_{i,B}$$

→ Observed response identifies "structural" elasticity ε

$$\varepsilon = -\frac{\mathbb{E}\log x^*_{i,B}(p_B) - \mathbb{E}\log x^*_{i,A}(p_A)}{\log p_B - \log p_A}$$

- How do frictions affect link between ε and observed response?

Frictions – Example 1: Adjustment Costs

- Suppose agent must pay fixed cost $k_{i,t}$ to change consumption

- Agent i now chooses $x_{i,t}$ by solving

$$\max_{x_t} \sum_{t=1}^{T} [a_{i,t} \frac{x_t^{1-1/\varepsilon}}{1-1/\varepsilon} - p_t x_t - k_{i,t} \bullet (x_t \neq x_{t-1})]$$

- Define "observed" elasticity as

$$\widehat{\varepsilon} = -\frac{\mathbb{E}\log x_{i,B}(p_B) - \mathbb{E}\log x_{i,A}(p_A)}{\log p_B - \log p_A}$$

- In short run, may observe $\varepsilon > \hat{\varepsilon}$ or $\varepsilon < \hat{\varepsilon}$ depending on evolution of prices, adjustment costs, and tastes

- But steady-state responses (permanent price variation from period 1) depend purely on ε

Frictions – Example 2: Price Misperception

- Let $\widetilde{p}_{i,t}(p_t)$ denote agent's perceived price at true price p

- Observed demand for good x is

$$\log x_{i,t}(p_t) = \alpha - \varepsilon \log \widetilde{p}_{i,t}(p_t) + \nu_{i,t}$$

- Observed elasticity confounds ε with change in perceptions

$$\widehat{\varepsilon} = \varepsilon \frac{\mathbb{E} \log \widetilde{p}_{i,B}(p_B) - \mathbb{E} \log \widetilde{p}_{i,A}(p_A)}{\log p_B - \log p_A}$$

- But if perceptions converge to truth in long run, steady-state behavior still depends on ε

→ Can we identify ε with fully identifying primitive sources of frictions?

Identification with Optimization Frictions

- Examples illustrate challenges of fully identifying models with frictions
  - Ex. 1: have to identify stochastic processes that govern taste shocks, prices, and adjustment costs
  - Ex. 2: need a theory of price perceptions
- Motivates a different approach: identify ε without fully identifying primitive sources of frictions
- Focus on identification, not inference
  - Assume we start with unbiased estimate $\hat{\varepsilon}$ from infinite sample
  - Inference in finite samples can be handled following Imbens and Manski (2004) and Chernozhukov, Hong, and Tamer (2007)

Frictions and Partial Identification

- Problem of identifying ε with unknown frictions can be viewed as a partial identification problem
- Define agent i's optimization error as (log) difference between observed and optimal demand:

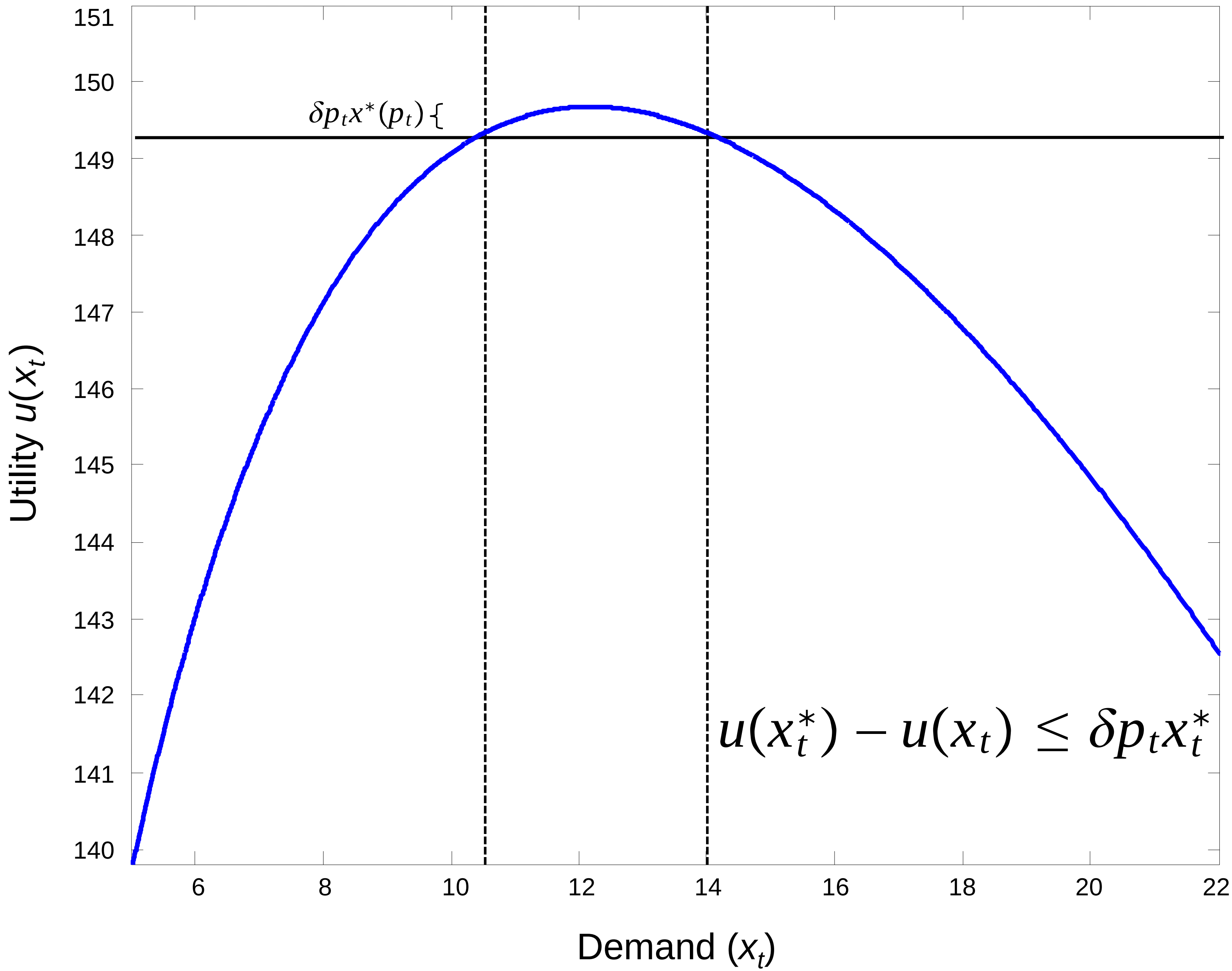
$$\phi_{i,t} = \log x_{i,t}(p_t) - \log x^*_{i,t}(p_t)$$

- Observed demand can be written as

$$\log x_{i,t}(p_t) = \alpha - \varepsilon \log p_t + \nu_{i,t} + \phi_{i,t}$$

- Difference between optimization error ($\phi_{i,t}$) and preference heterogeneity error ($\nu_{i,t}$): $\phi_{i,t}$ is **not** orthogonal to changes in prices
  - Cannot assume that $\mathbb{E}\phi_{i,t} = 0$
- But with no restrictions on $\phi_{i,t}$ at all, ε is unidentified

Restricting the Degree of Frictions when Utility is Quasilinear



Restricting the Degree of Frictions

- Models that generate demand x_t such that utility loss is less than δ pct. of expenditure are a "δ class of models" around nominal model

- Examples considered earlier are elements of a δ class of models around standard lifecycle model

  - Ex 1: Adjustment cost model with $\delta = 2 \times$ mean adj cost.

  - Ex 2: Misperceptions that generate utility costs $< \delta\%$ on average

- A δ class of models maps price to a choice **set** $X(p_t, \delta)$ instead of a single point $x^*(p_t)$

Restricting the Degree of Frictions

- Without quasilinear utility, restriction is based on expenditure function

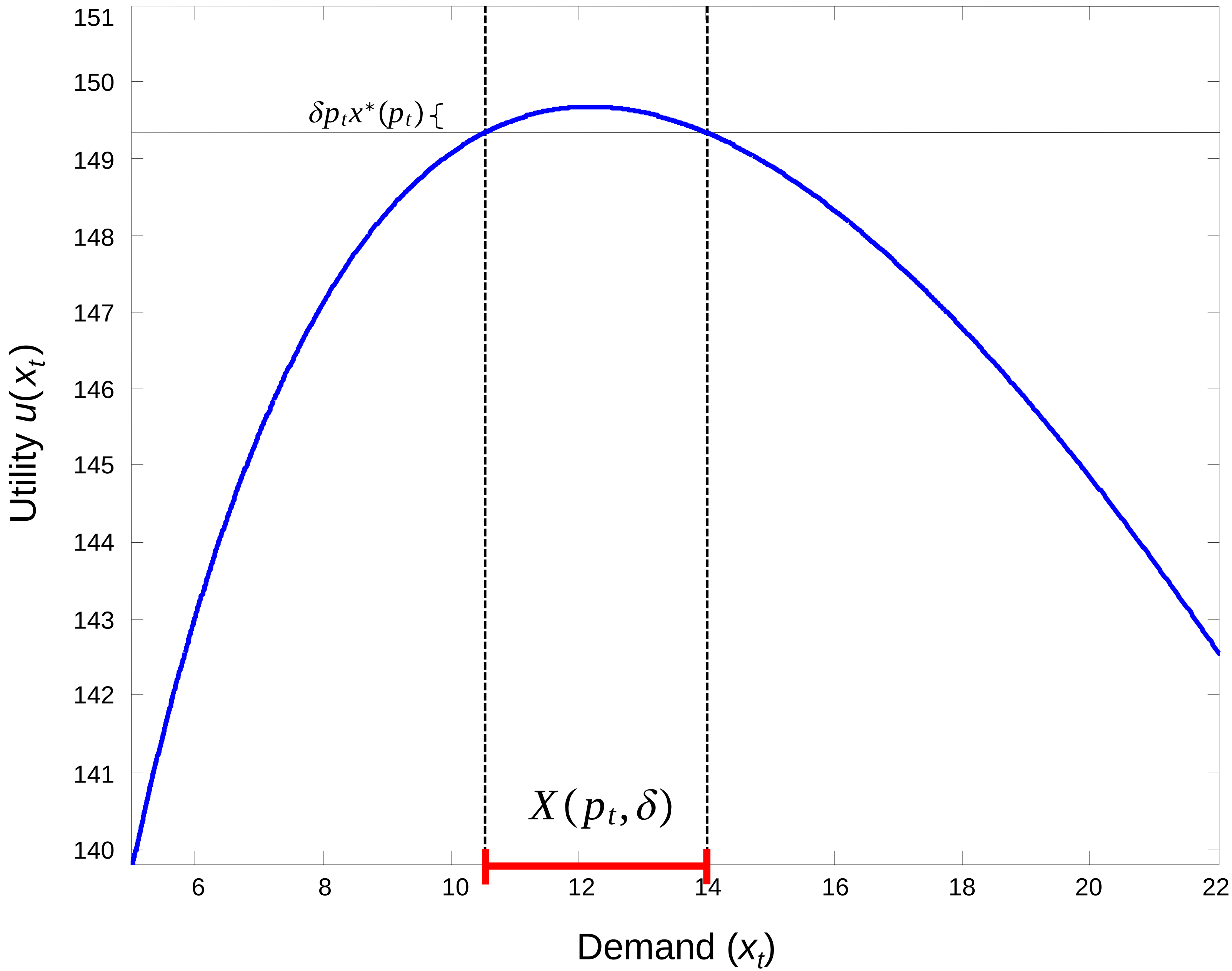
- Minimum expenditure needed to attain optimal utility with $x_t = \tilde{x}_t$:

$$e_{i,t}(\tilde{x}_t) = \min_{x_s, y_s} \sum_{s=t}^{T} (p_s x_s + y_s) \text{ s.t. } \sum_{s=t}^{T} v_{i,t}(x_s, y_s) \geq U_{i,t}^{*} \text{ and } x_t = \tilde{x}_t$$

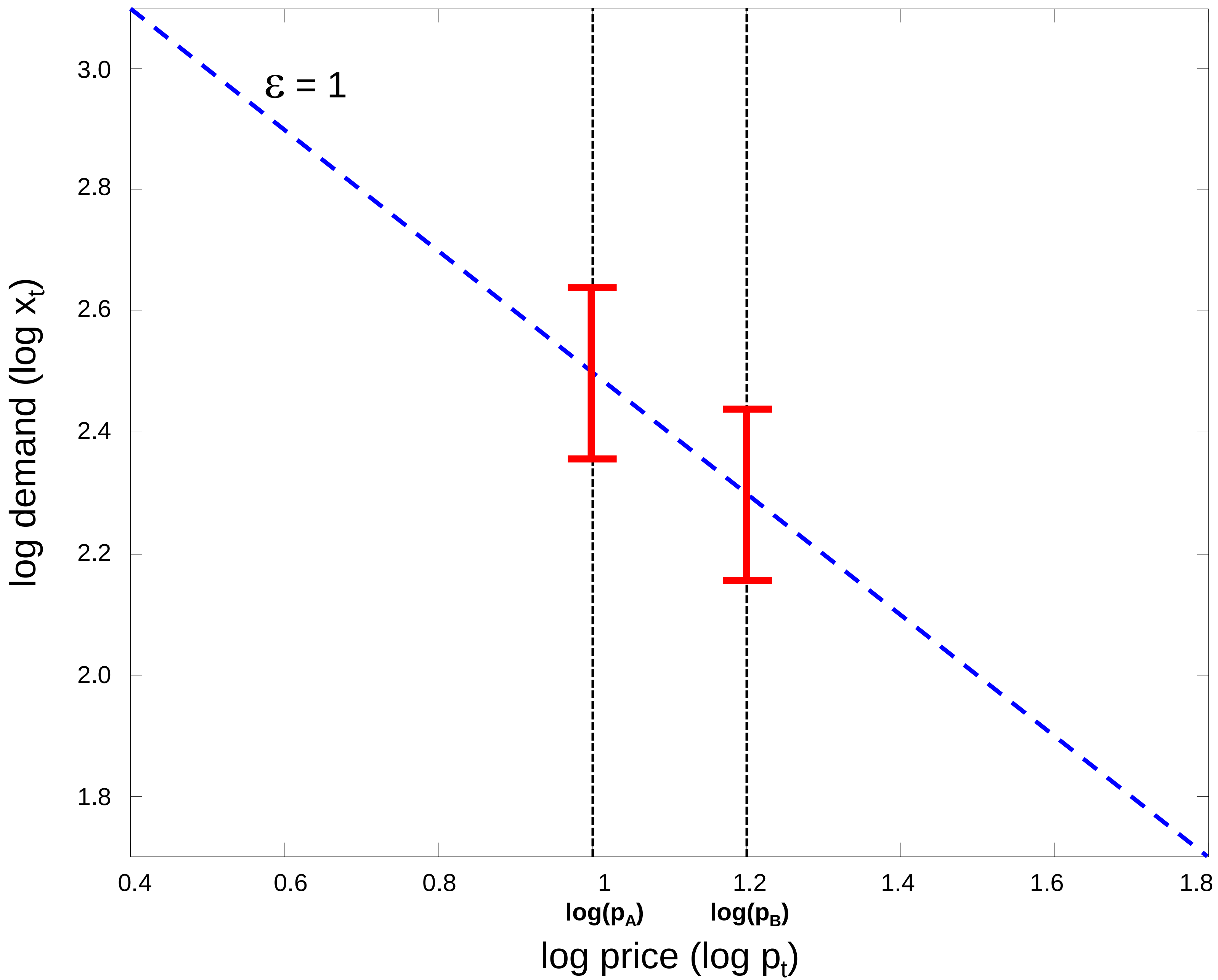
- Restriction: average expenditure loss is less than δ

$$\frac{1}{N} \sum_i [e_{i,t}(x_{i,t}^{*}) - e_{i,t}(x_{i,t})]/p_t x_{i,t}^{*} \leq \delta$$

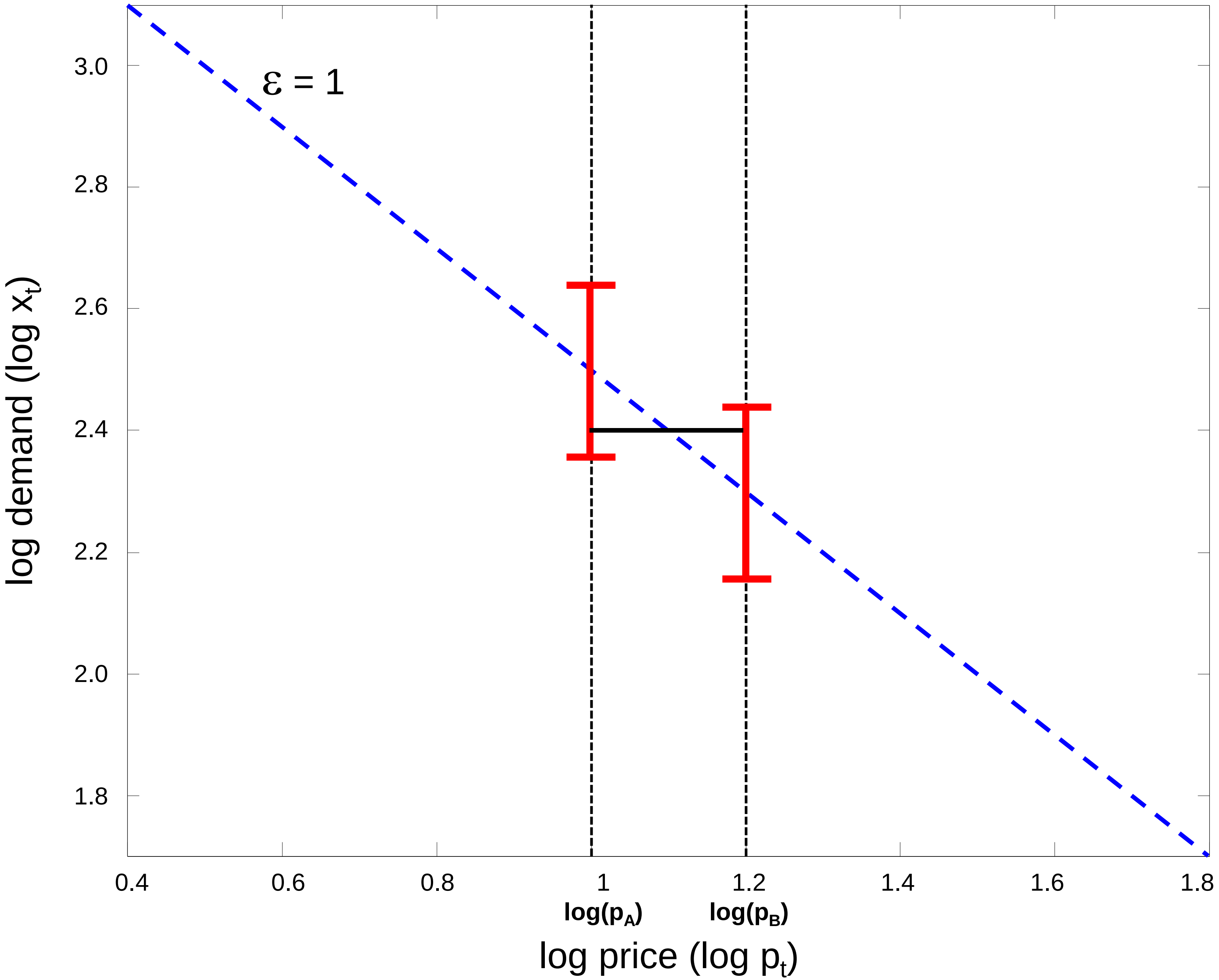
Construction of Choice Set when Utility is Quasilinear



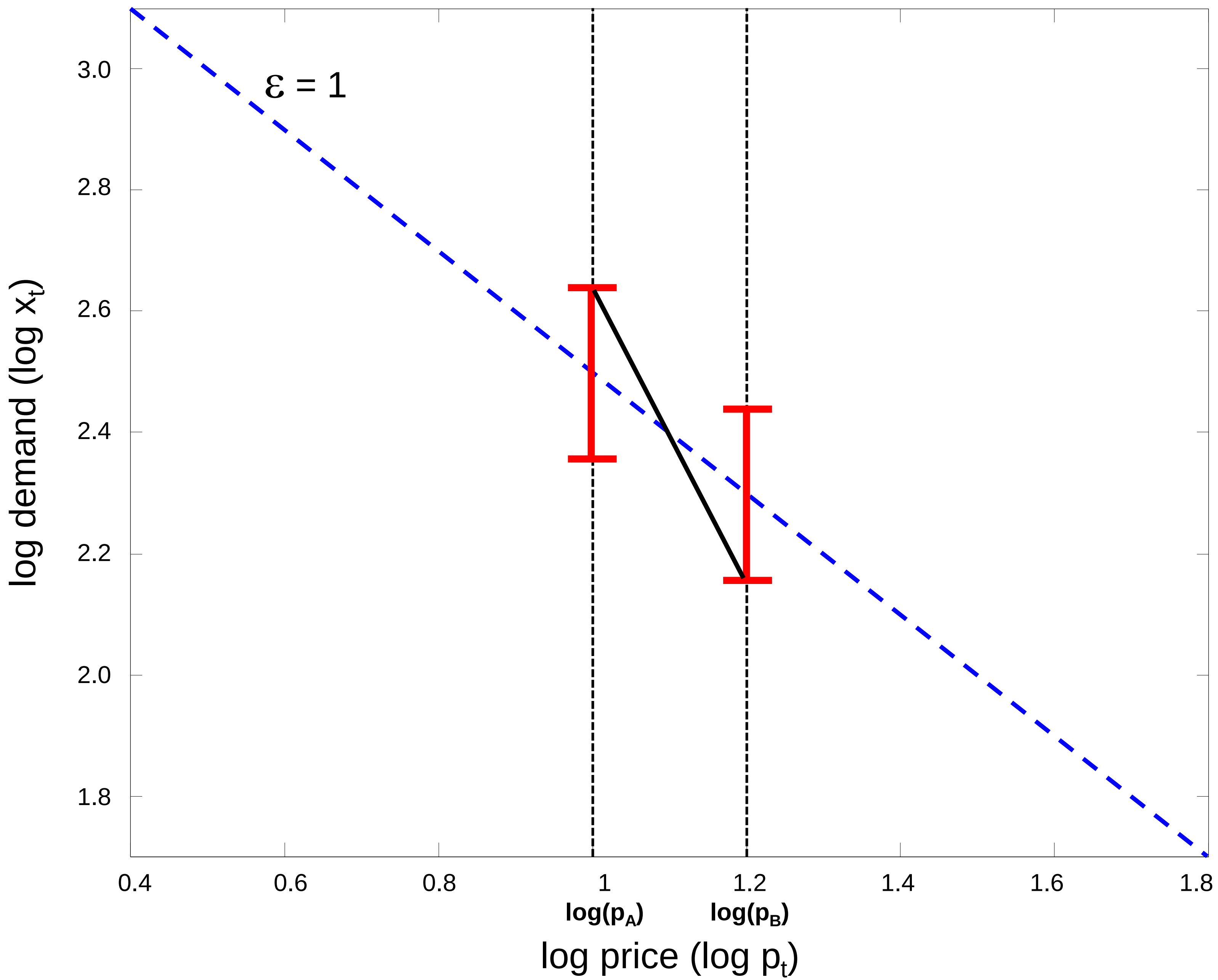
Identification with Optimization Frictions



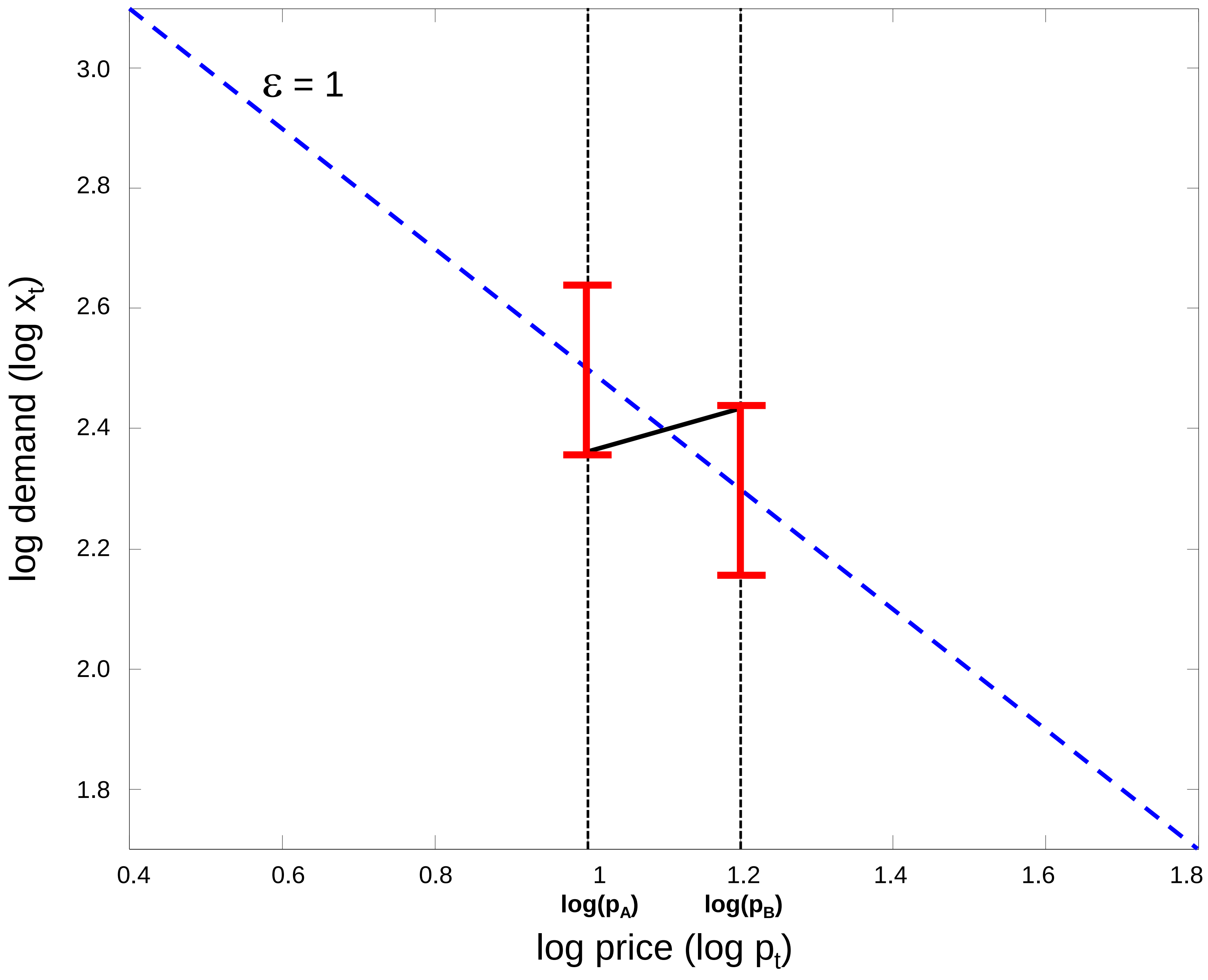
Identification with Optimization Frictions



Identification with Optimization Frictions



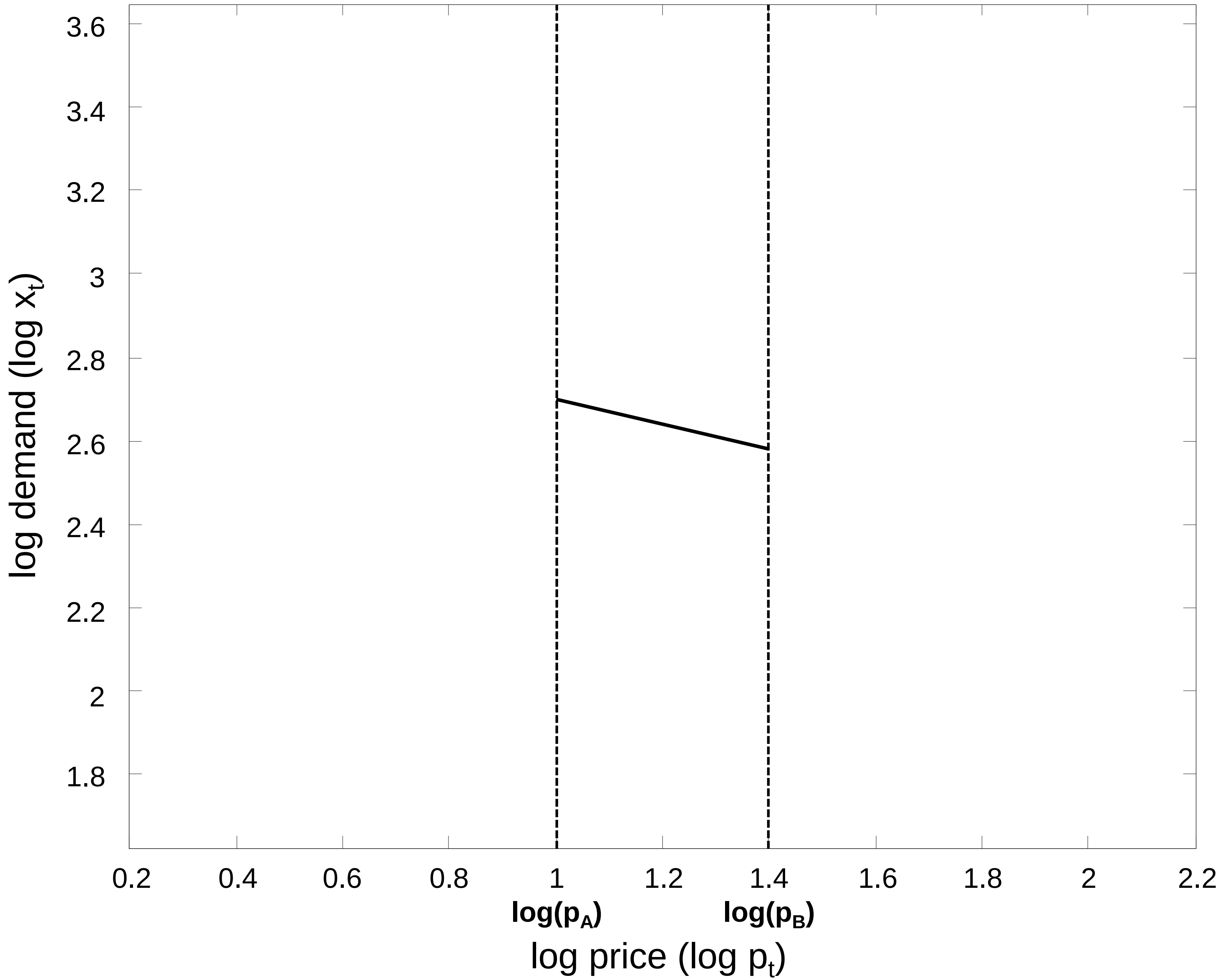
Identification with Optimization Frictions

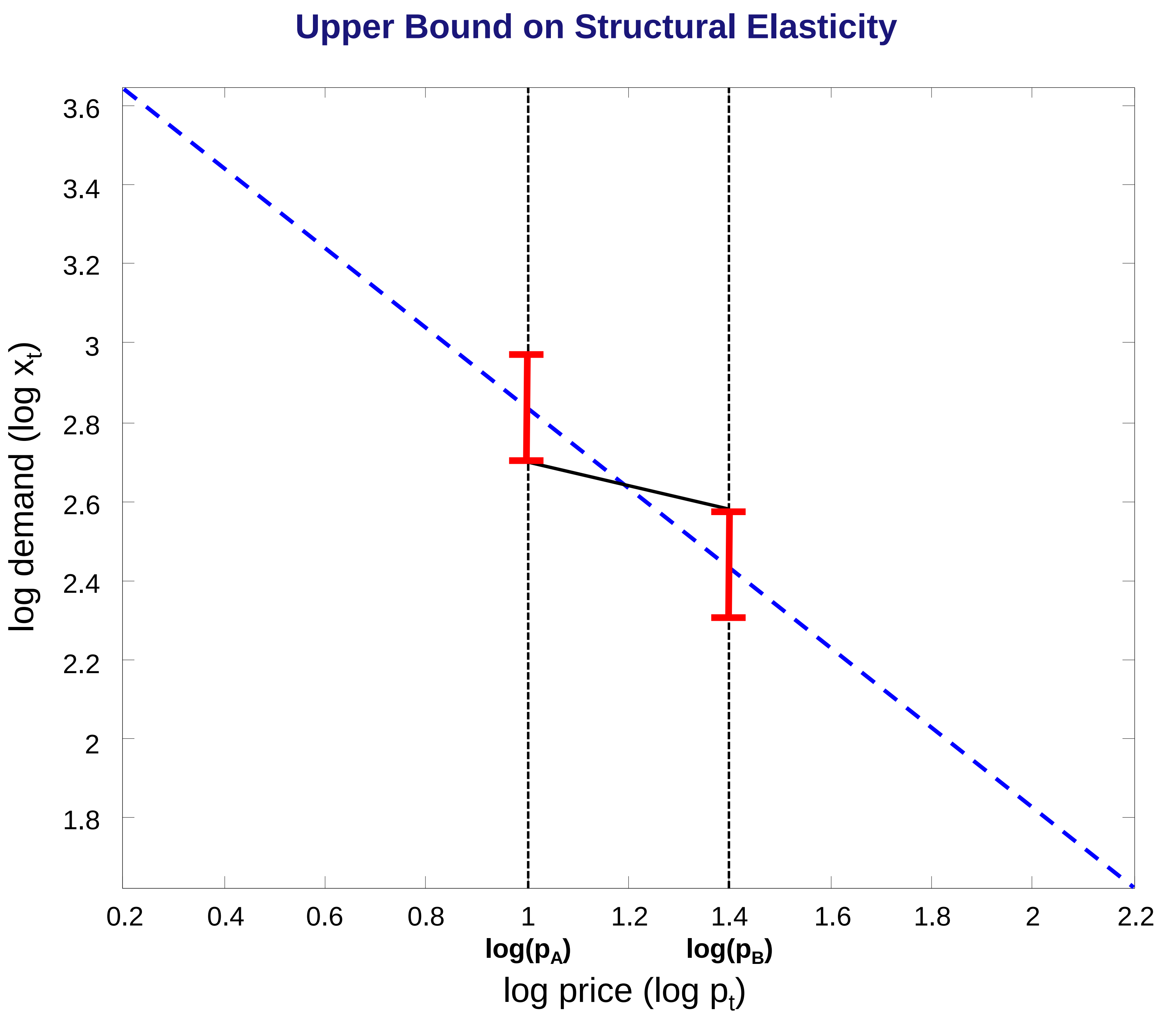


Bounding the Structural Elasticity

- Many structural elasticities ε consistent with an observed elasticity $\hat{\varepsilon}$
- Objective: characterize smallest and largest elasticities $(\varepsilon_L, \varepsilon_U)$ consistent with an observed elasticity in a δ class of models
- Effectively exchanging orthogonality condition on error term for bounded support condition

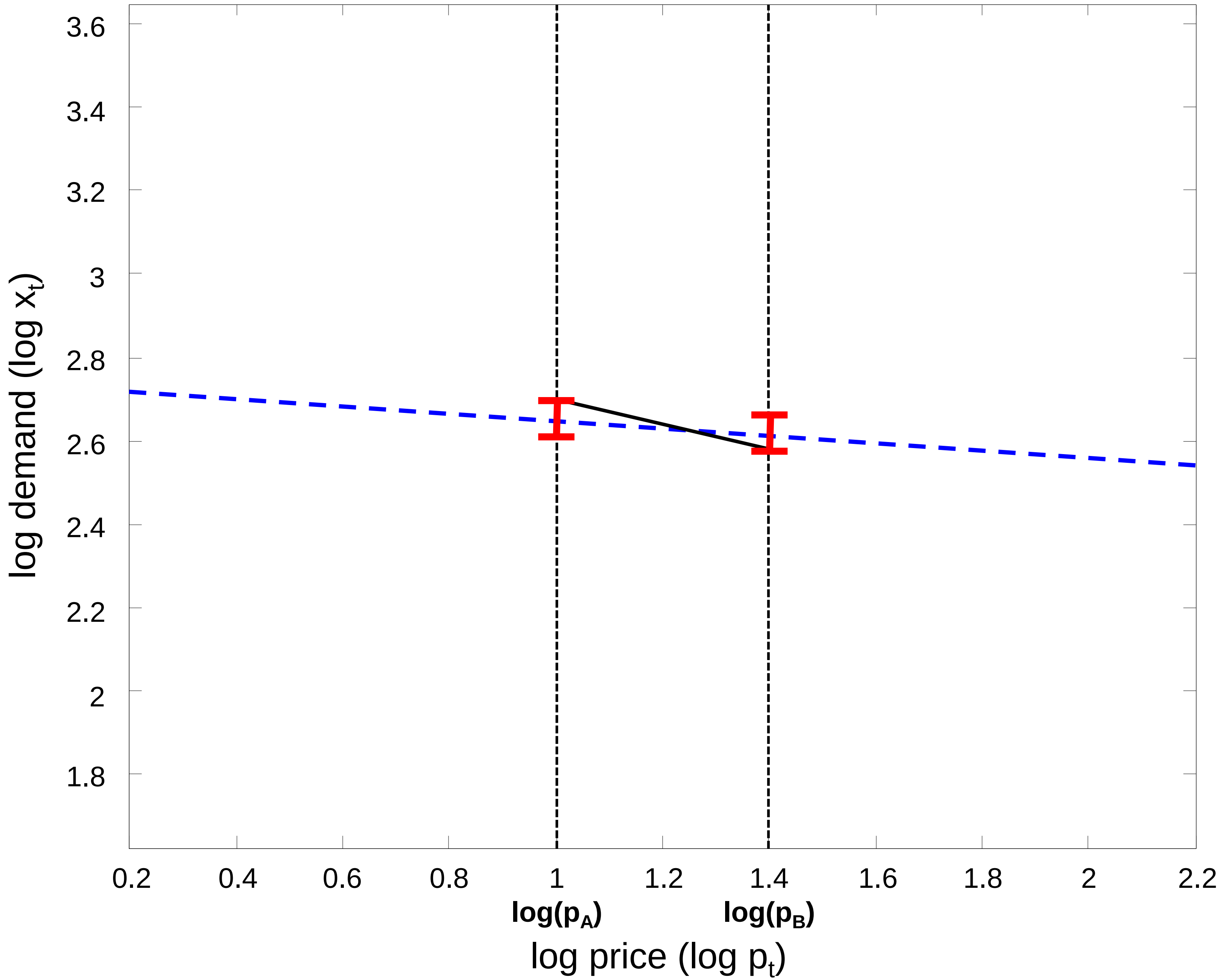
Calculation of Bounds on Structural Elasticity





Upper Bound on Structural Elasticity
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
log demand (log x_t)
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
log(p_A)
log(p_B)
log price (log p_t)

Lower Bound on Structural Elasticity



Bounds on Elasticities with Frictions

Proposition 1. For small δ, the range of structural Hicksian elasticities consistent with an observed elasticity $\hat{\varepsilon}$ is $(\varepsilon_L, \varepsilon_U)$:

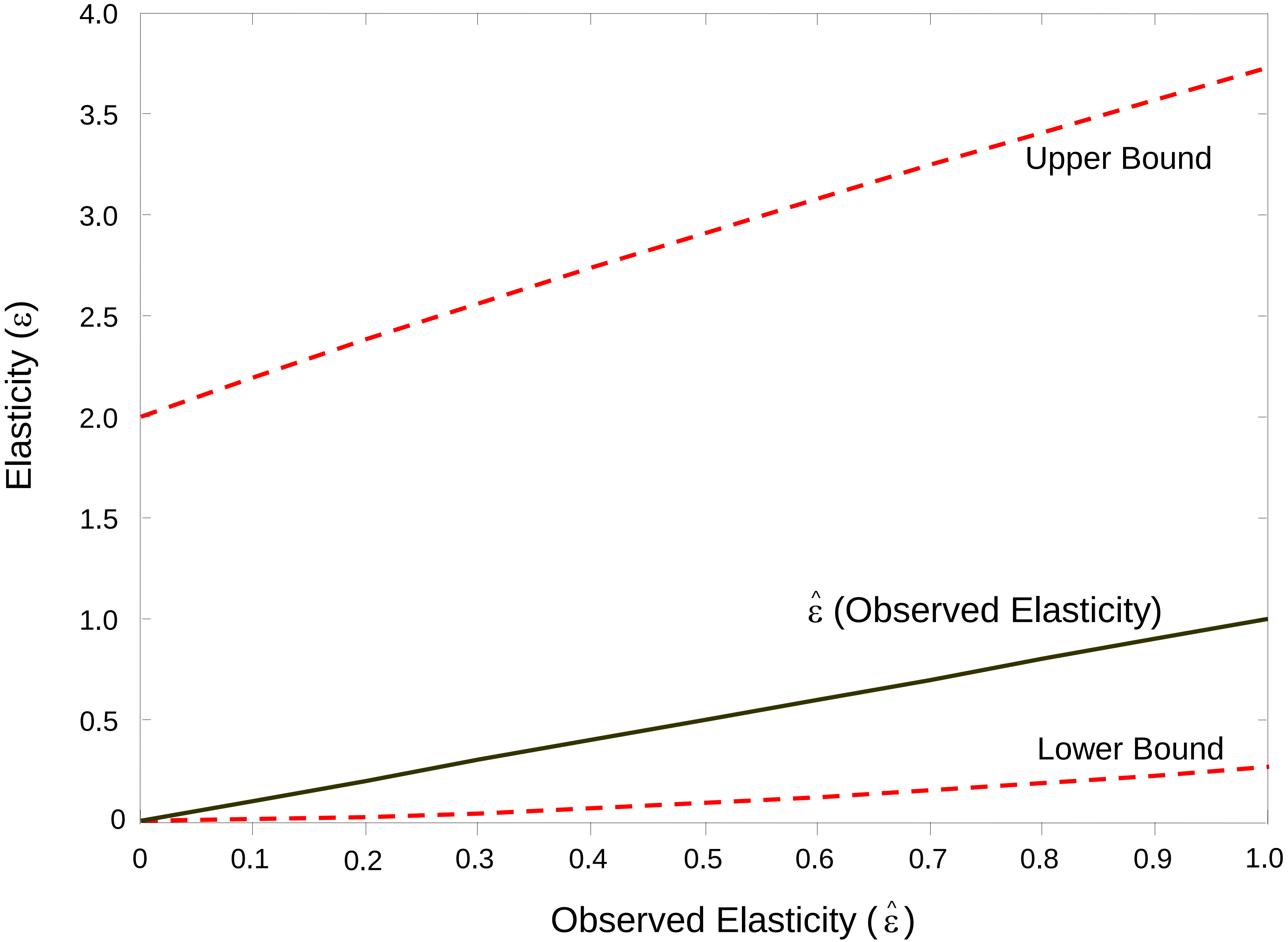
$$\varepsilon_L = \widehat{\varepsilon} + \frac{4\delta}{(\Delta \log p)^2}(1 - \rho) \text{ and } \varepsilon_U = \widehat{\varepsilon} + \frac{4\delta}{(\Delta \log p)^2}(1 + \rho)$$

where $\rho = (1 + \frac{1}{2}\frac{\widehat{\varepsilon}}{\delta}(\Delta \log p)^2)^{1/2}$

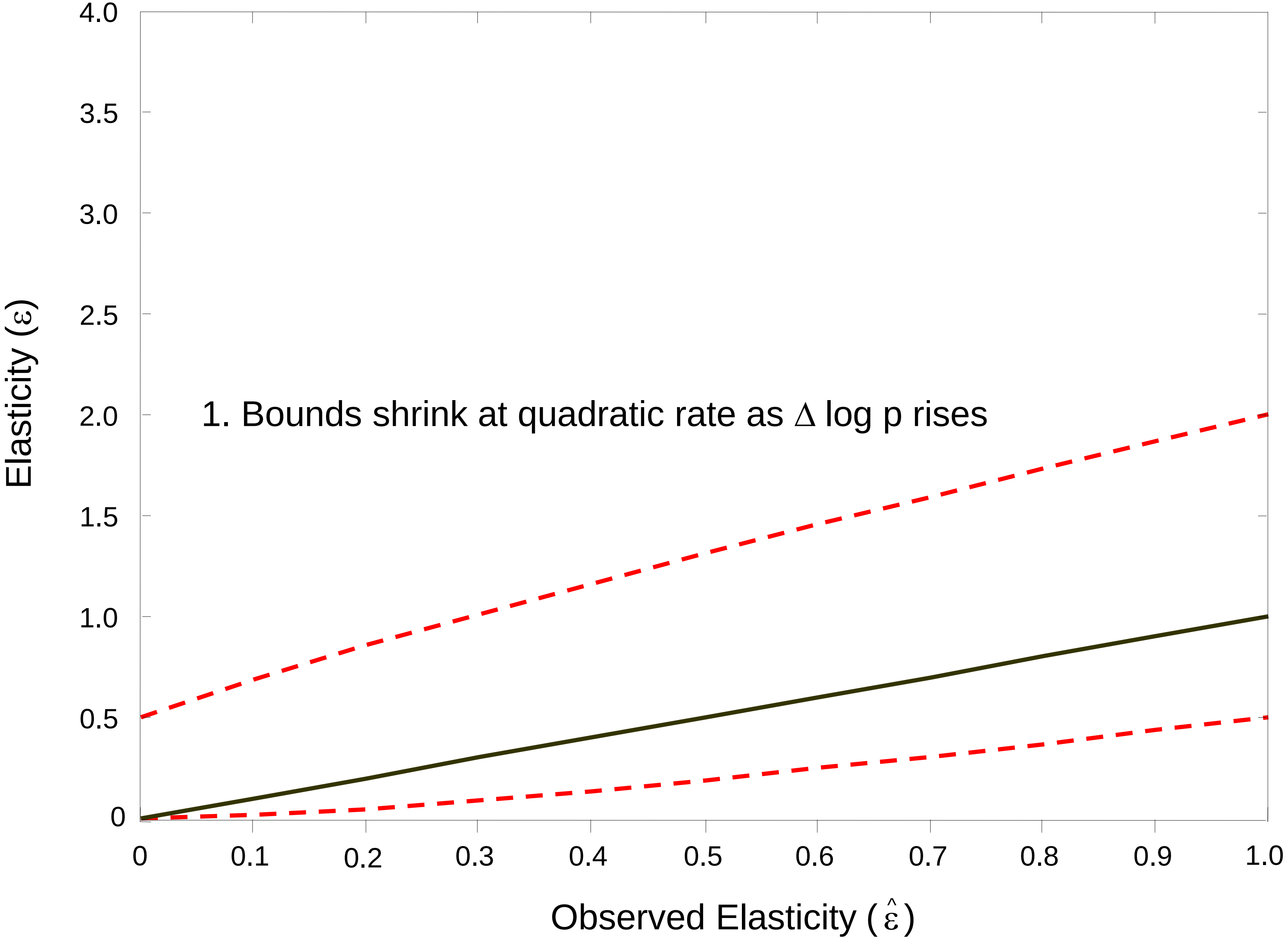
- Maps an observed elasticity $\hat{\varepsilon}$, size of price change $\Delta \log p$, and degree of optimization frictions δ to bounds on ε

- Inference in finite samples can be handled using standard methods in set identification (e.g. Imbens and Manski 2004)

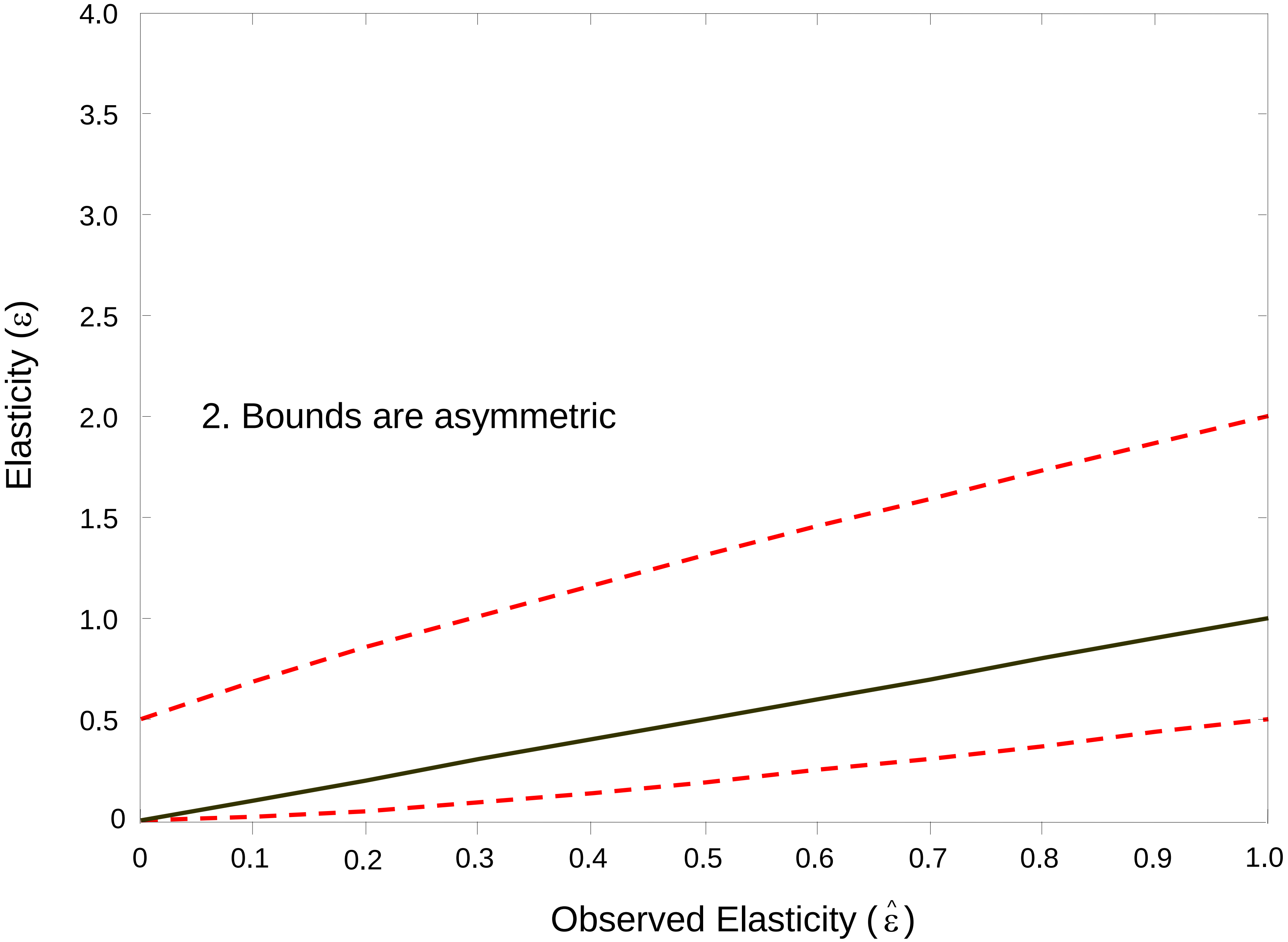
Bounds on Structural Elasticities: δ = 1%, Δ log p = 20%



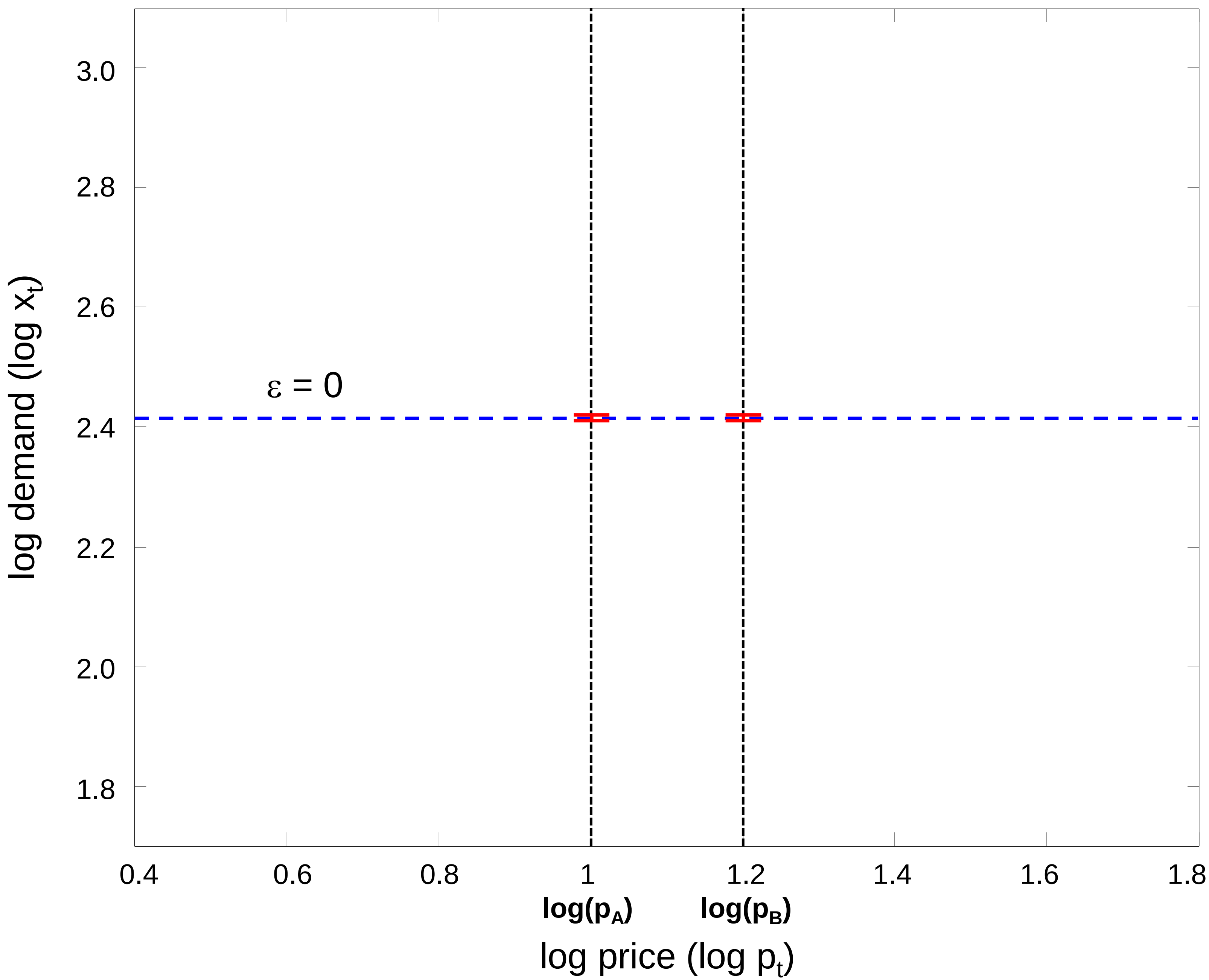
Bounds on Structural Elasticities: δ = 1%, Δ log p = 40%



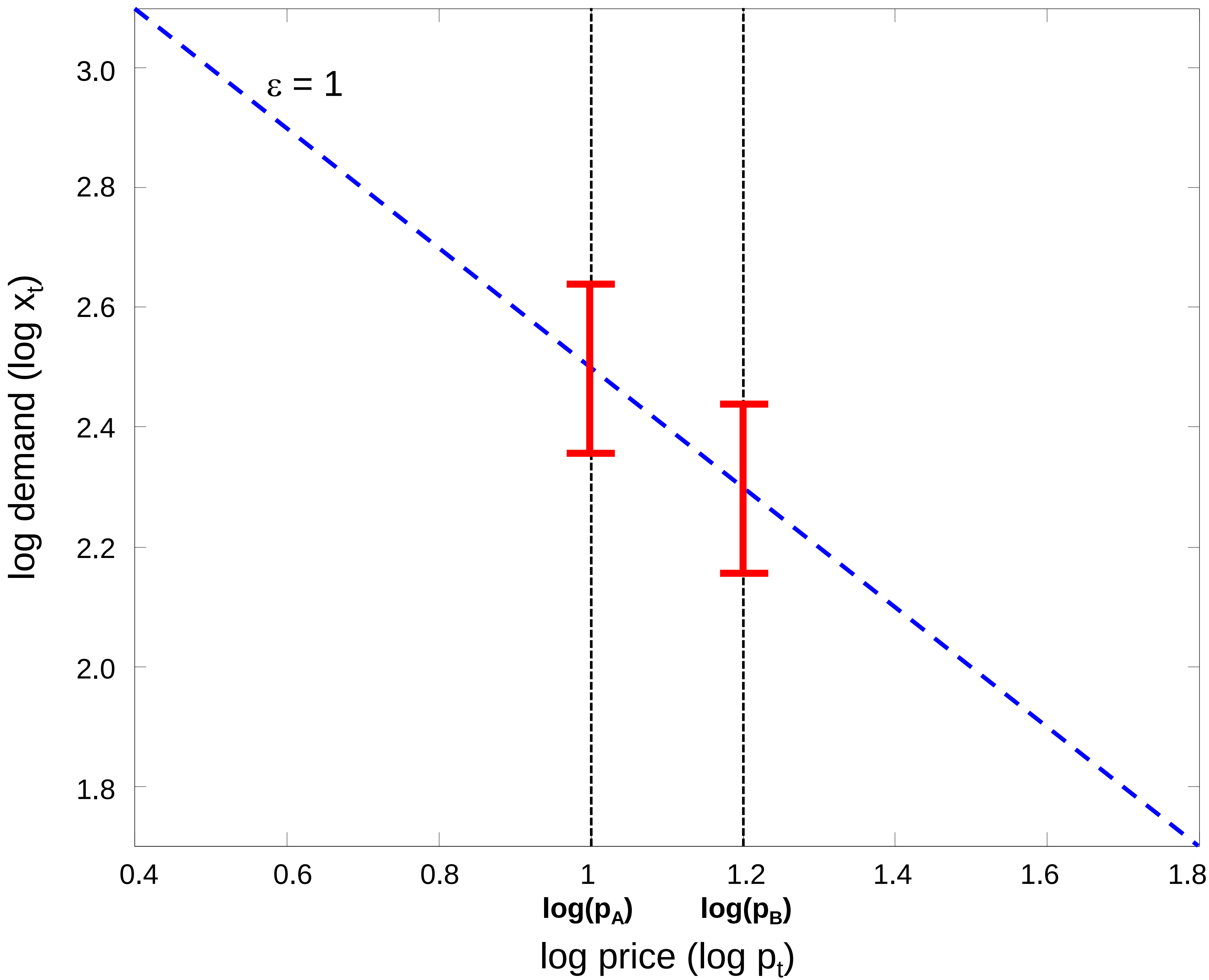
Bounds on Structural Elasticities: δ = 1%, Δ log p = 40%



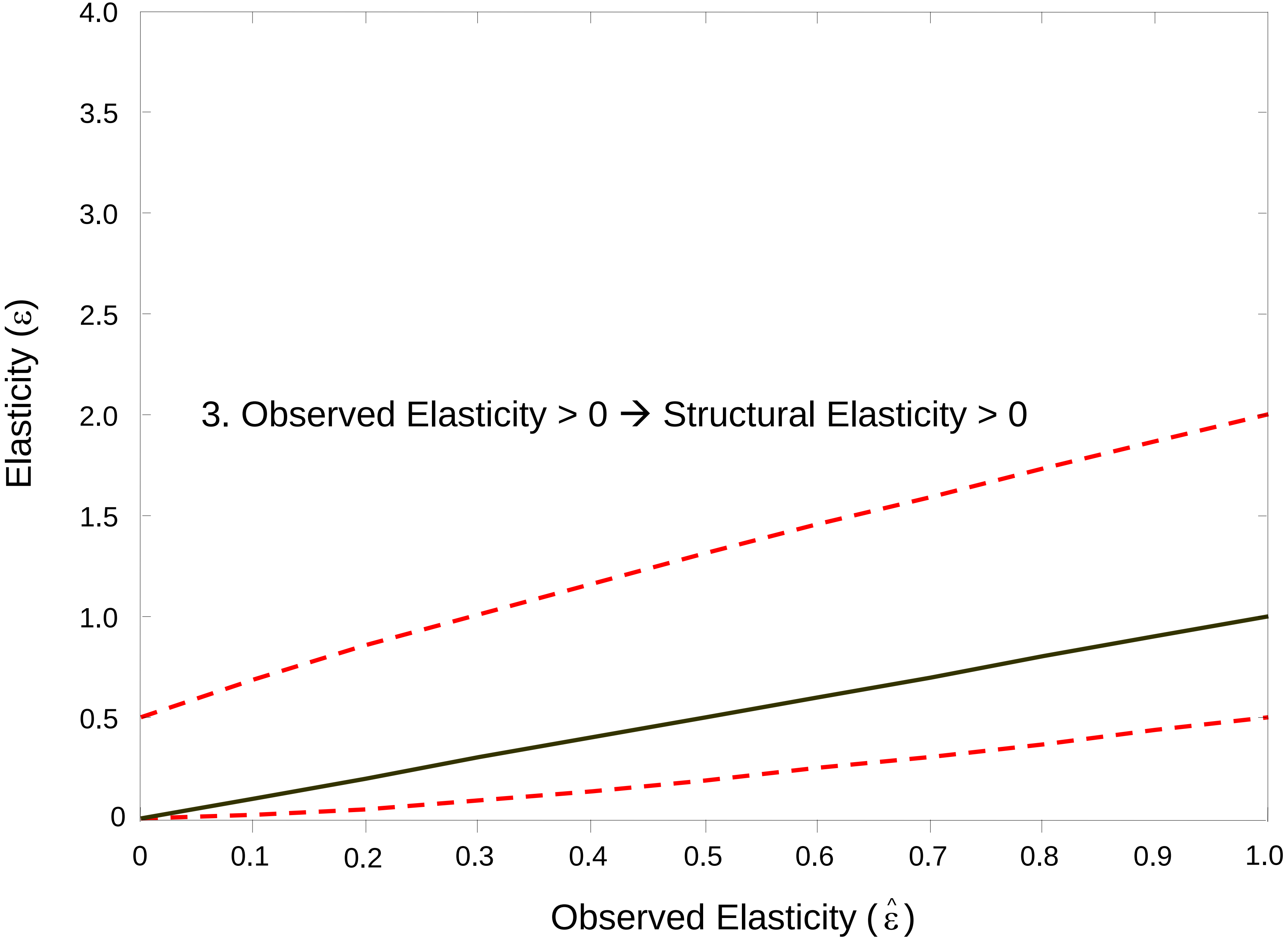
Effect of Structural Elasticities on Choice Sets



Effect of Structural Elasticities on Choice Sets



Bounds on Structural Elasticities: δ = 1%, Δ log p = 40%



Extensive Margin Responses

- Now consider bounds on extensive margin elasticities
- Assume that $x_t \in \{0,1\}$ and flow utility is

$$v_{i,t}(x_t, y_t) = y_t + b_{i,t} x_t$$

- Let $F_t(b_{i,t})$ denote distribution of tastes for x
- Agents optimally buy x if taste $b_{i,t} > p_t$ → $\theta_t^* = 1 - F(p_t)$
- Let structural extensive elasticity be denoted by

$$\eta(p_A, p_B) \equiv \frac{\log \theta_B^*(p_B) - \log \theta_A^*(p_A)}{\log(p_B) - \log(p_A)}$$

- Let $\theta_t =$ observed participation rate and $\hat{\eta}$ = observed extensive elasticity

Bounds on Extensive Margin Elasticities

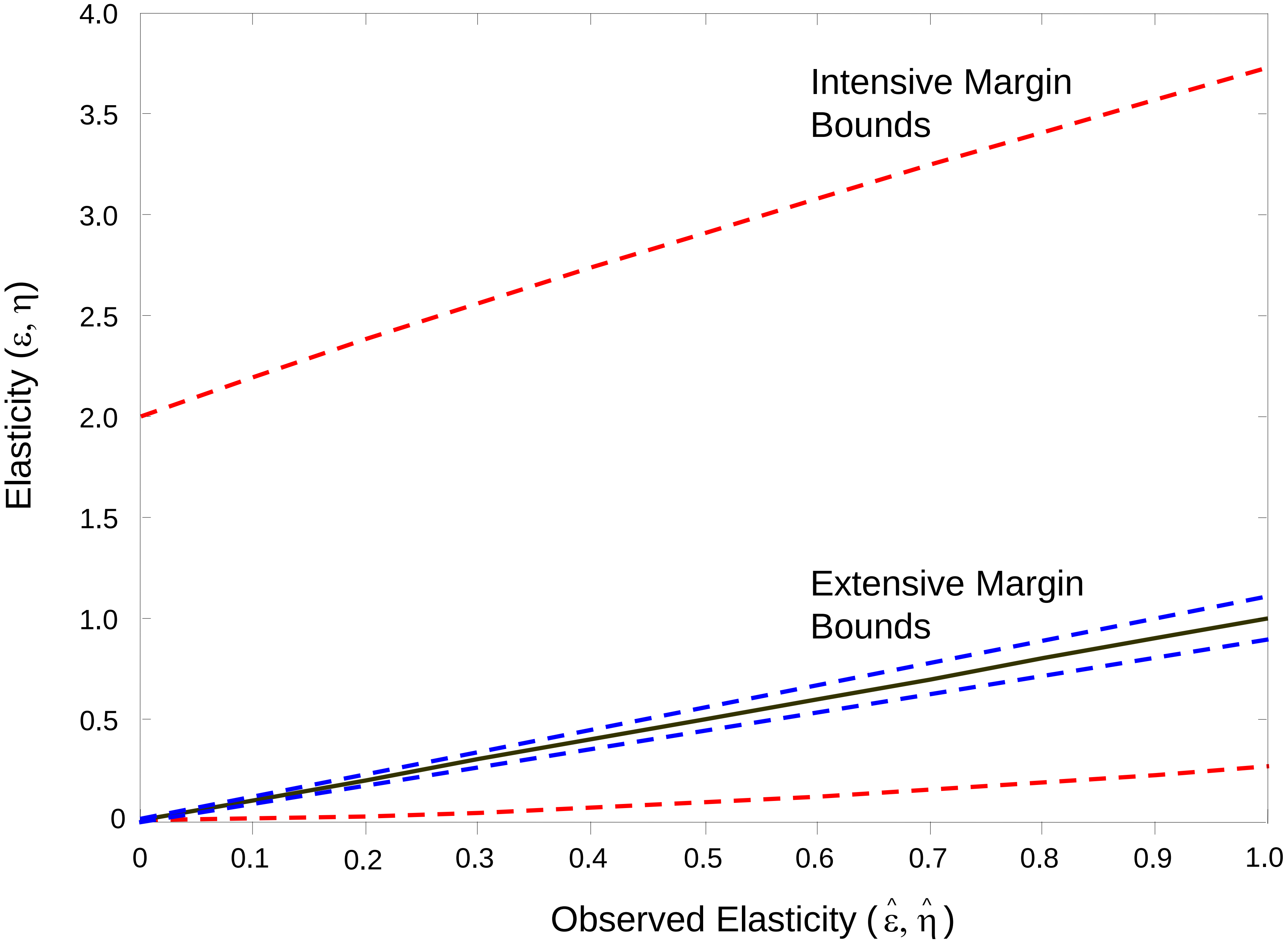
Proposition 2. For small δ, the range of structural extensive margin elasticities consistent with an observed extensive elasticity $\hat{\eta}$ is (η_L, η_U):

$$\eta_L = \hat{\eta}/(1+\rho_\eta) \text{ and } \eta_U = \hat{\eta}/(1-\rho_\eta)$$

where $\rho_\eta = \frac{2\delta}{\Delta \log p}$

- Key difference relative to intensive margin: bounds shrink linearly with δ rather than in proportion to $\delta^{1/2}$

Bounds on Structural Elasticities: δ = 1%, Δ log p = 20%



Bounds on Extensive Margin Elasticities

Proposition 2. For small δ, the range of structural extensive margin elasticities consistent with an observed extensive elasticity $\hat{\eta}$ is (η_L, η_U):

$$\eta_L = \hat{\eta}/(1+\rho_\eta) \text{ and } \eta_U = \hat{\eta}/(1-\rho_\eta)$$

$$\text{where} \quad \rho_\eta = \frac{2\delta}{\Delta \log p}$$

- Key difference relative to intensive margin: bounds shrink linearly with δ rather than in proportion to $\delta^{1/2}$
- Intuition: agents are not near optima to begin with on extensive margin → first-order utility losses from failing to reoptimize
  - Marginal agent loses benefit of price cut if he doesn't enter market

Application: Labor Supply

1. Intensive margin elasticities
2. Extensive margin elasticities
3. Non-linear budget set estimation
4. Micro vs. macro elasticities

Nominal Labor Supply Model

- Standard lifecycle model of labor supply (MaCurdy 1981)

$$\max_{c_t, l_t} \sum_{t=1}^{T} v_{i,t}(c_t, l_t) \text{ s.t. } \sum_{t=1}^{T} [Y_{i,t} + (1-\tau_t)wl_t - c_t] = 0$$

- Bounds apply to this model with

  - $\Delta \log p$ replaced with $\Delta \log(1-\tau_t)$

  - $\varepsilon =$ Hicksian elasticity of l^* (or taxable income, wl^*) w.r.t. $1-\tau$

  - $\delta =$ utility loss as a percentage of net-of-tax earnings

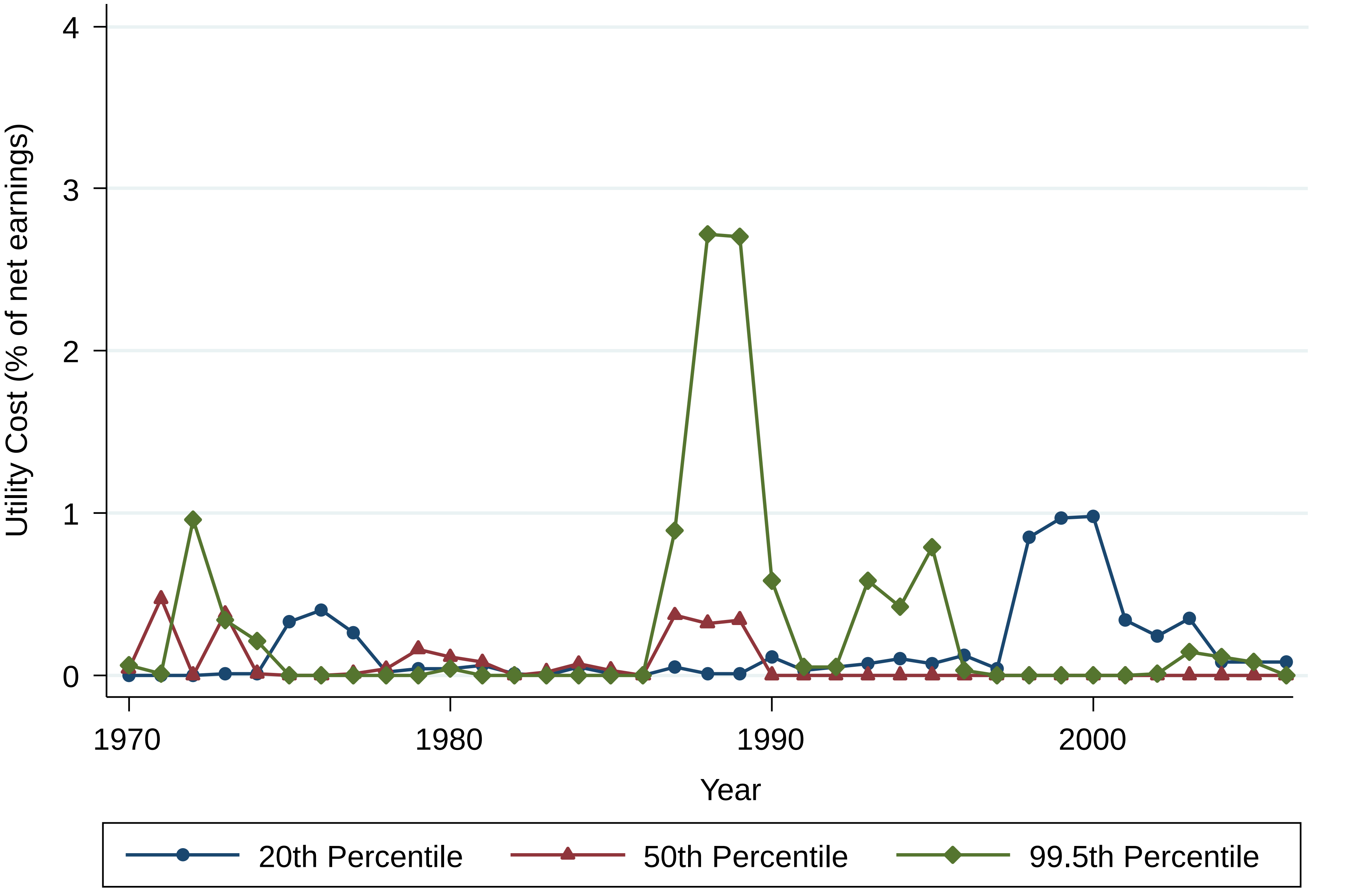
Utility Costs of Ignoring Tax Changes

- First calculate utility loss of ignoring tax changes with $\varepsilon = 0.5$
  - Consider a single tax filer with two children

- [Corollary of Prop. 1] Given structural elasticity ε:

  Utility cost $< 4\delta$ → ε consistent with zero observed response ($\hat{\varepsilon} = 0$)

Utility Cost of Ignoring Tax Changes with ε = 0.5: Intensive Margin



Bounds on Intensive Margin Elasticity

- What can be learned about structural elasticity from existing estimates?

- Collect estimates from a broad range of studies that estimate intensive margin Hicksian elasticities

- Calculate bounds on the intensive margin structural elasticity with frictions of $\delta = 1\%$ of net earnings

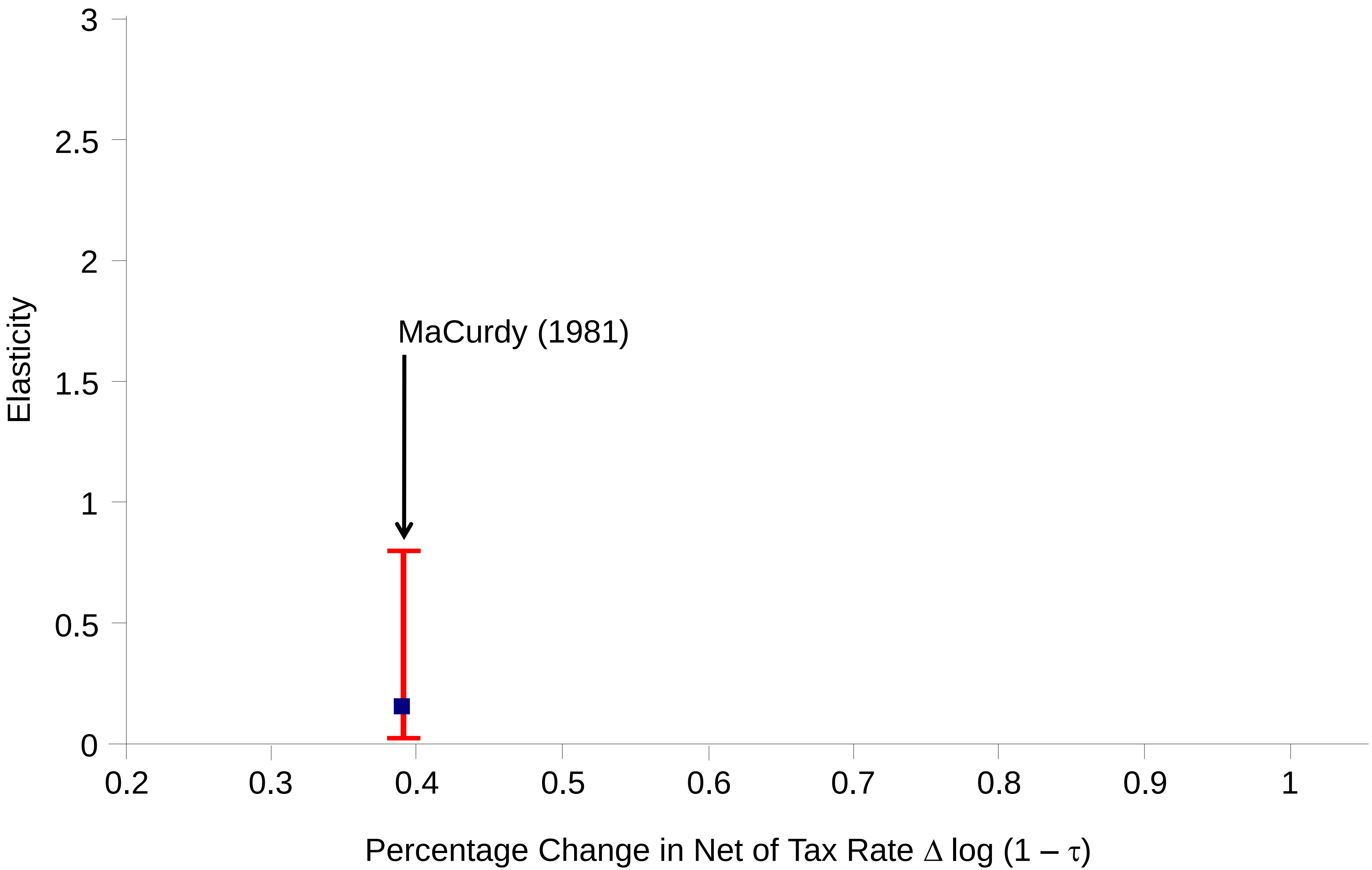
Bounds on Intensive-Margin Hicksian Elasticities with δ = 1% Frictions

Study	Identification	$\hat{\varepsilon}$	se($\hat{\varepsilon}$)	Δlog(1-τ)	ε_L	ε_U
(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Hours Elasticities						
1. MaCurdy (1981)	Lifecycle wage variation, 1967-1976	0.15	0.15	0.39	0.03	0.80
2. Eissa and Hoynes (1998)	U.S. EITC, 1984-1996, Men	0.20	0.07	0.07	0.00	15.29
3. Eissa and Hoynes (1998)	U.S. EITC, 1984-1996, Women	0.09	0.07	0.07	0.00	15.07
4. Blundell et al. (1998)	U.K. Tax Reforms, 1978-1992	0.14	0.09	0.23	0.01	1.78
5. Ziliak and Kniesner (1999)	Lifecycle wage, tax variation 1978-1987	0.15	0.07	0.39	0.03	0.80
	Mean observed elasticity	**0.15**				
B. Taxable Income Elasticities						
6. Bianchi et al. (2001)	Iceland 1987 Zero Tax Year	0.37	0.05	0.49	0.15	0.92
7. Gruber and Saez (2002)	U.S. Tax Reforms 1979-1991	0.14	0.14	0.14	0.00	4.42
8. Saez (2004)	U.S. Tax Reforms 1960-2000	0.09	0.04	0.15	0.00	3.51
9. Jacob and Ludwig (2008)	Chicago Housing Voucher Lottery	0.12	0.03	0.36	0.02	0.84
10. Gelber (2010)	Sweden, 1991 Tax Reform, Women	0.49	0.02	0.71	0.28	0.86
11. Gelber (2010)	Sweden, 1991 Tax Reform, Men	0.25	0.02	0.71	0.12	0.54
12. Saez (2010)	U.S., 1st EITC Kink, 1995-2004	0.00	0.02	0.34	0.00	0.70
13. Chetty et al. (2011a)	Denmark, Top Kinks, 1994-2001	0.02	0.00	0.30	0.00	0.93
14. Chetty et al. (2011a)	Denmark, Middle Kinks, 1994-2001	0.00	0.00	0.11	0.00	6.62
15. Chetty et al. (2011a)	Denmark Tax Reforms, 1994-2001	0.00	0.00	0.09	0.00	9.88
	Mean observed elasticity	**0.15**				

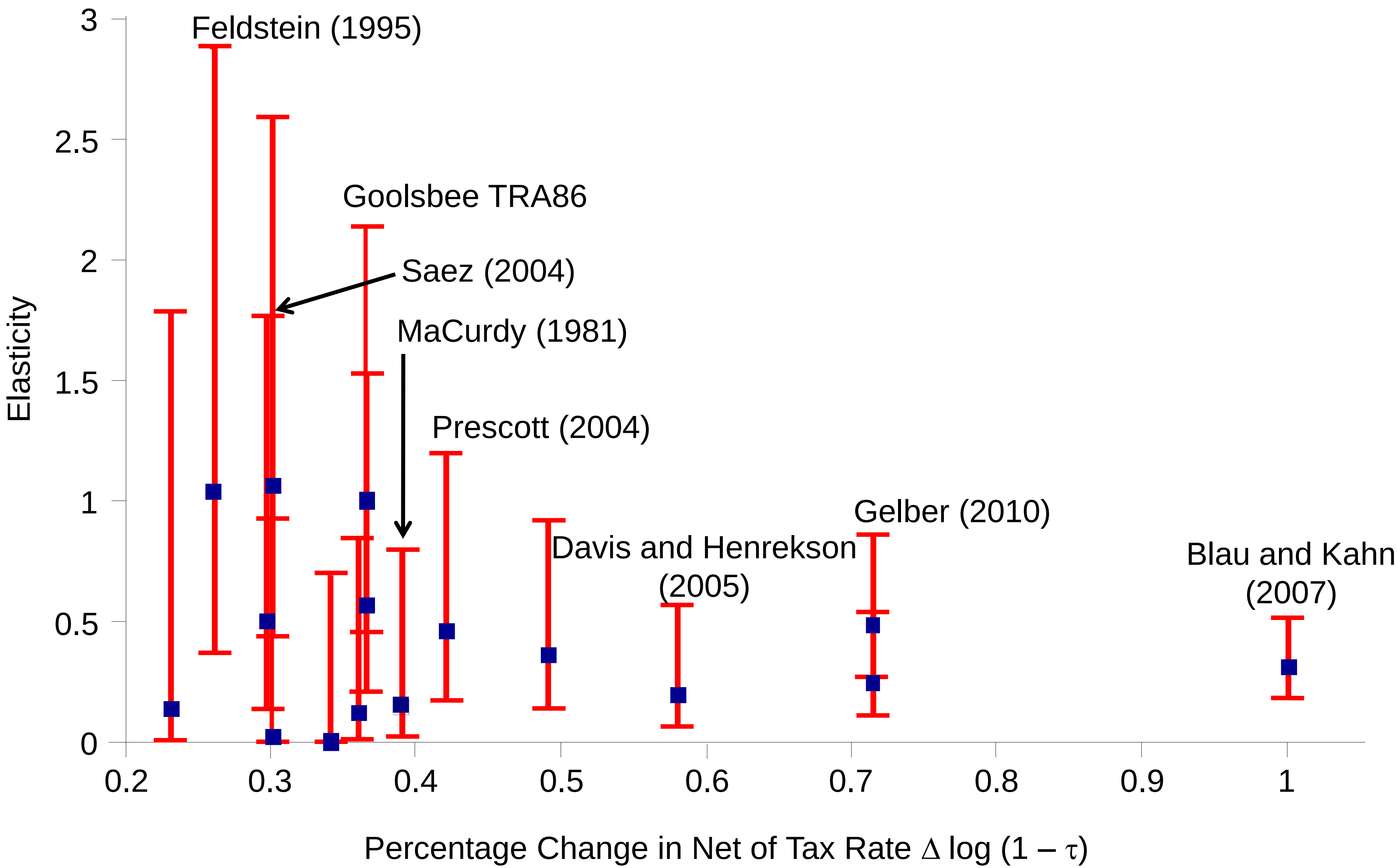
Bounds on Intensive-Margin Hicksian Elasticities with δ = 1% Frictions

Study (1)	Identification (2)	$\hat{\varepsilon}$ (3)	se($\hat{\varepsilon}$) (4)	Δlog(1-τ) (5)	ε_L (6)	ε_U (7)
C. Top Income Elasticities						
16. Feldstein (1995)	U.S. Tax Reform Act of 1986	1.04		0.26	0.37	2.89
17. Auten and Carroll (1999)	U.S. Tax Reform Act of 1986	0.57	0.12	0.37	0.21	1.53
18. Goolsbee (1999)	U.S. Tax Reform Act of 1986	1.00	0.15	0.37	0.47	2.14
19. Saez (2004)	U.S. Tax Reforms 1960-2000	0.50	0.18	0.30	0.14	1.77
20. Kopczuk (2010)	Poland, 2002 Tax Reform	1.07	0.22	0.30	0.44	2.58
	Mean observed elasticity	**0.84**				
D. Macro/Cross-Sectional						
21. Prescott (2004)	Cross-country Tax Variation, 1970-96	0.46	0.09	0.42	0.18	1.20
22. Davis and Henrekson (2005)	Cross-country Tax Variation, 1995	0.20	0.08	0.58	0.07	0.57
23. Blau and Kahn (2007)	U.S. wage variation, 1980-2000	0.31	0.004	1.00	0.19	0.51
	Mean observed elasticity	**0.32**				
				Unified Bounds Using Panels A and B:	0.28	0.54
				Minimum-δ Estimate ($\varepsilon_{\delta\text{-min}}$):	0.33	
				Unified Bounds Using All Panels:	0.47	0.51
				Minimum-δ Estimate ($\varepsilon_{\delta\text{-min}}$):	0.50	

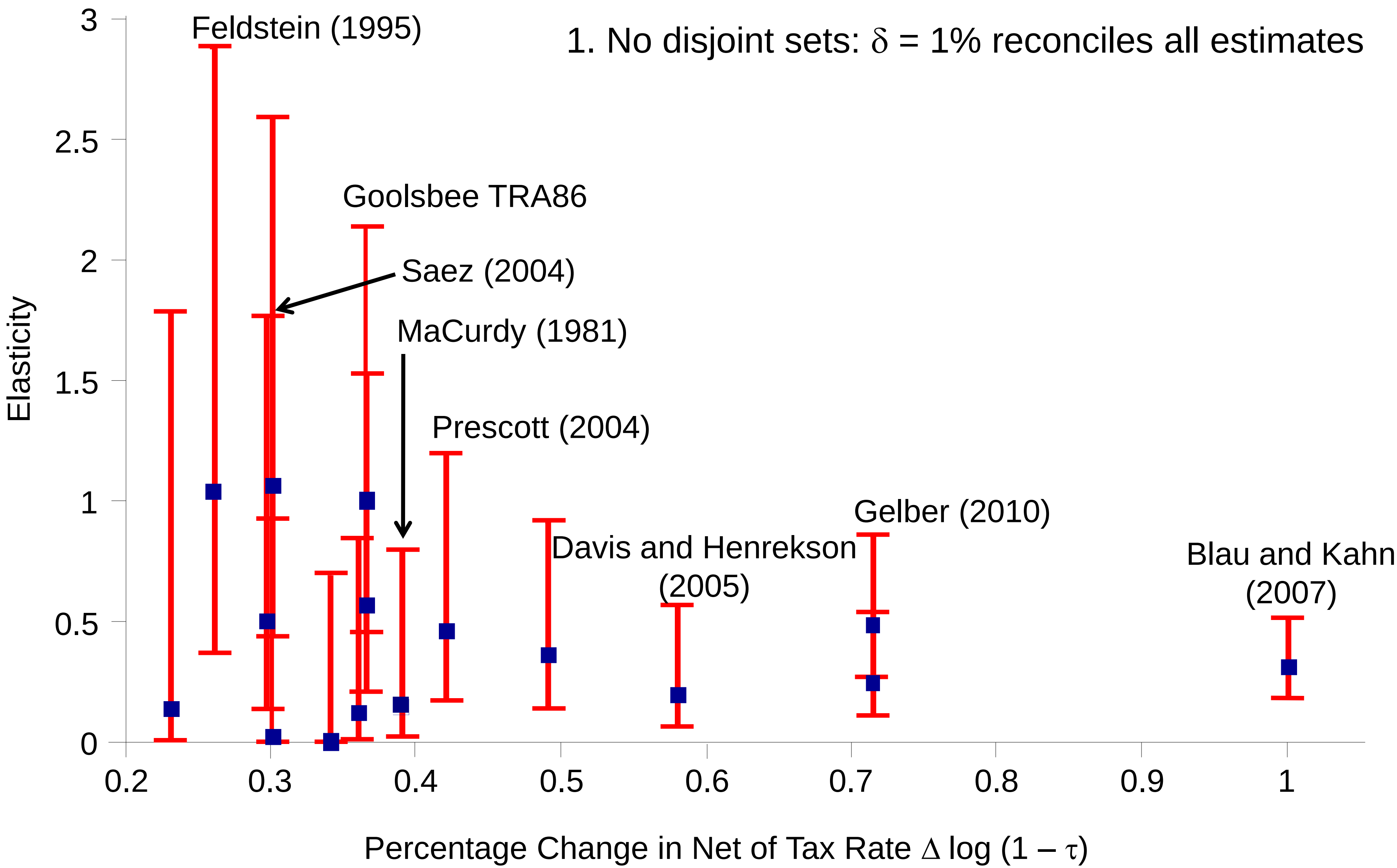
Bounds on Intensive-Margin Hicksian Elasticities with δ=1%



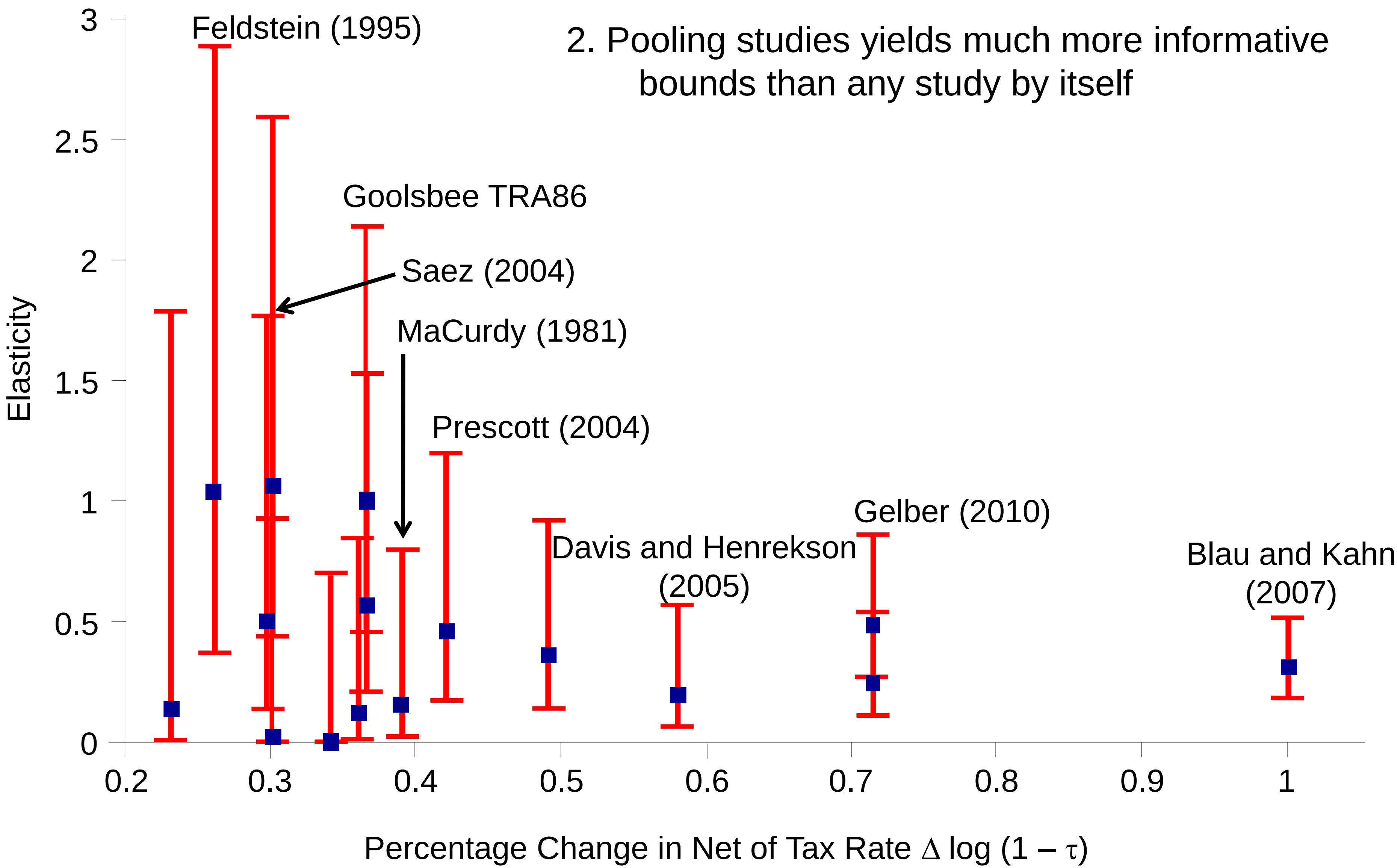
Bounds on Intensive-Margin Hicksian Elasticities with δ=1%



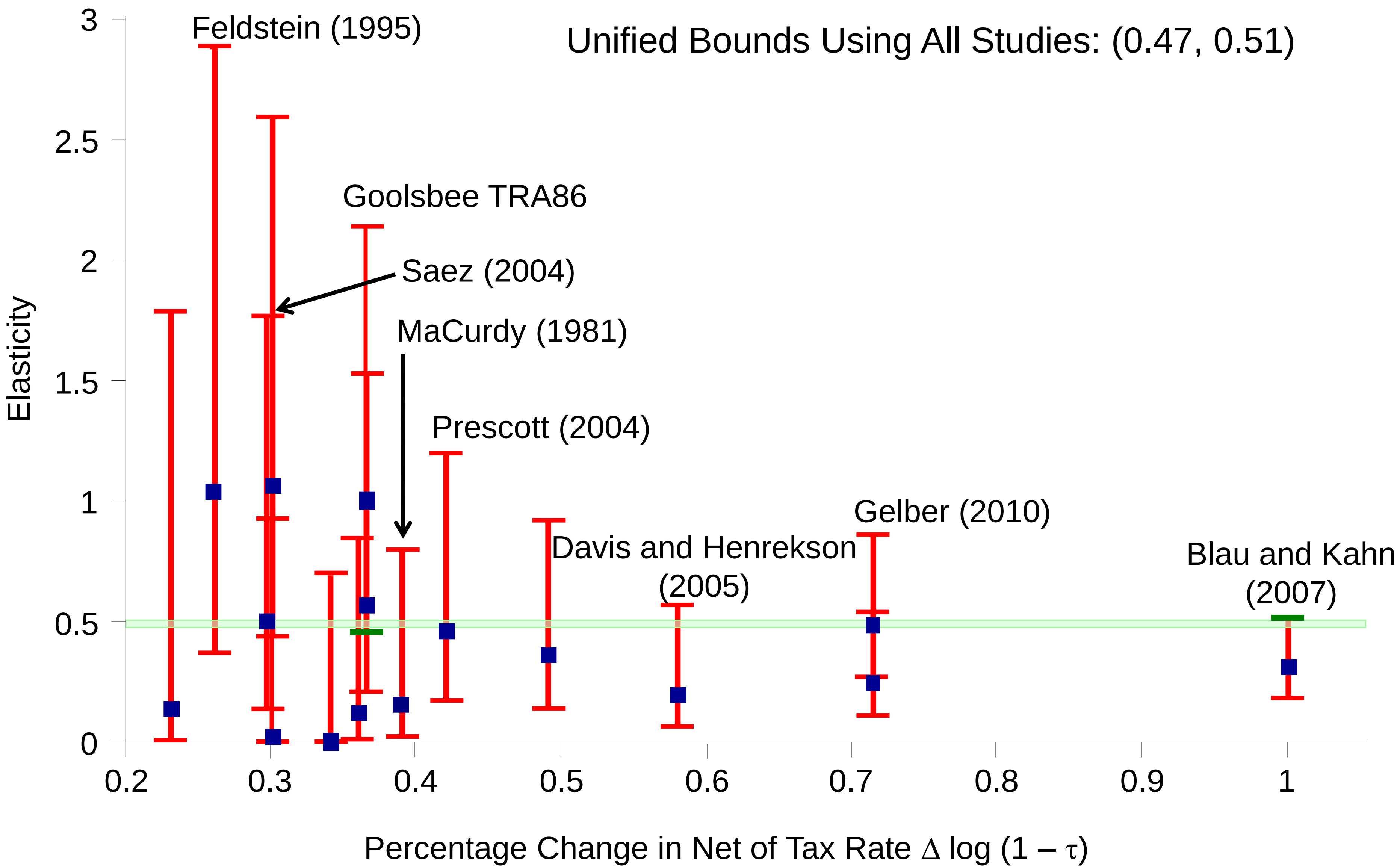
Bounds on Intensive-Margin Hicksian Elasticities with δ=1%



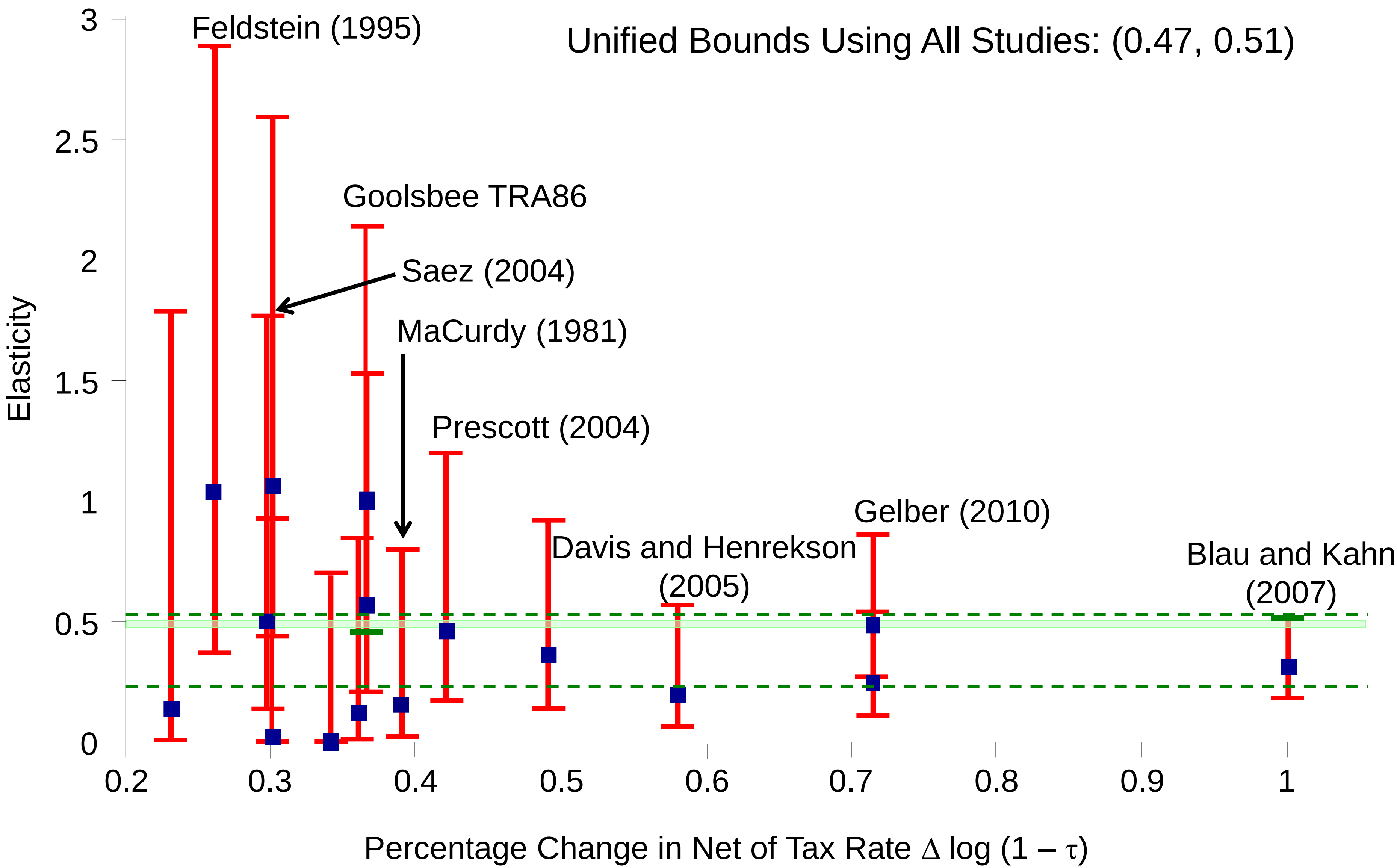
Bounds on Intensive-Margin Hicksian Elasticities with δ=1%



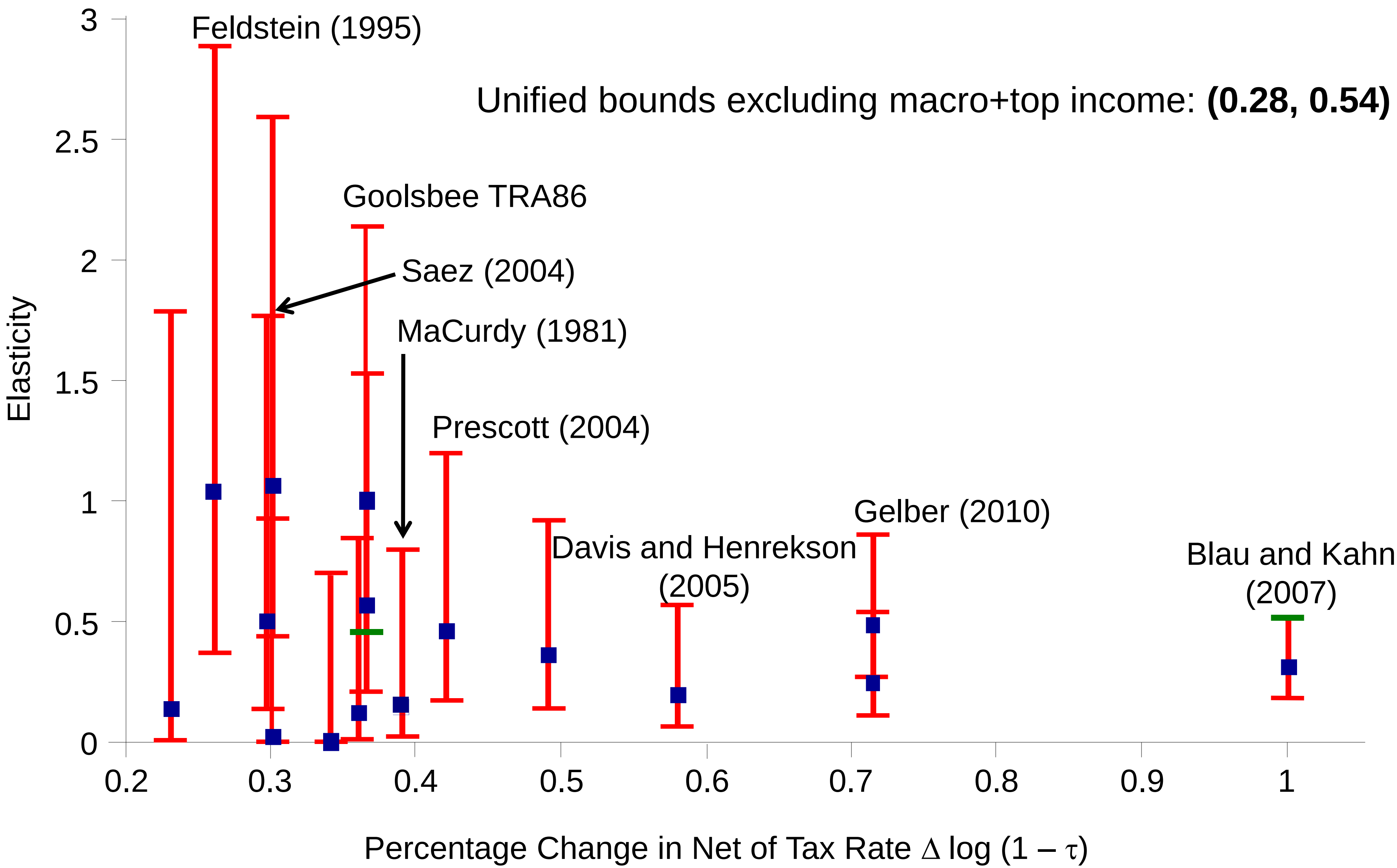
Bounds on Intensive-Margin Hicksian Elasticities with δ=1%

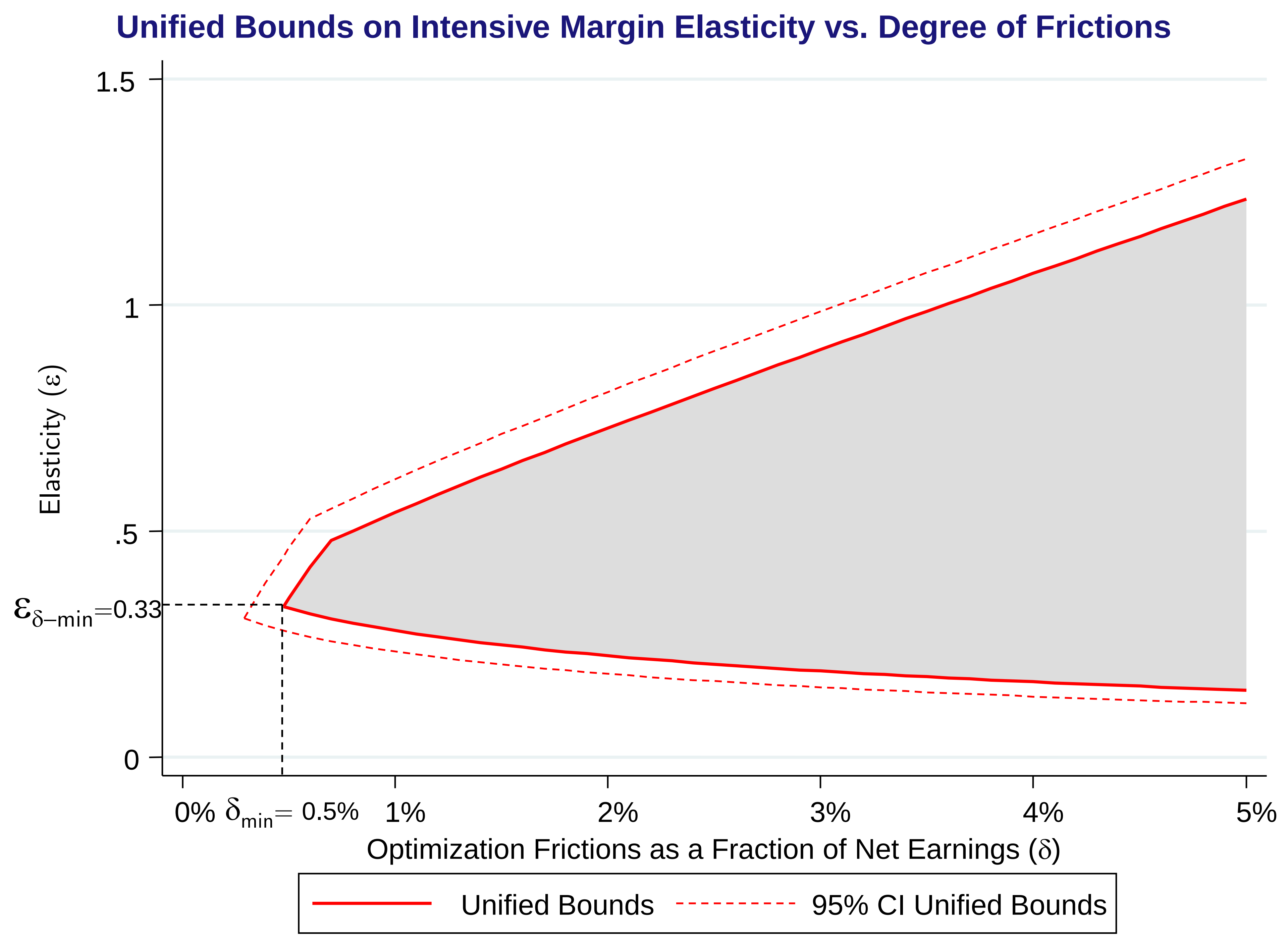


Bounds on Intensive-Margin Hicksian Elasticities with δ=1%



Bounds on Intensive-Margin Hicksian Elasticities with δ=1%



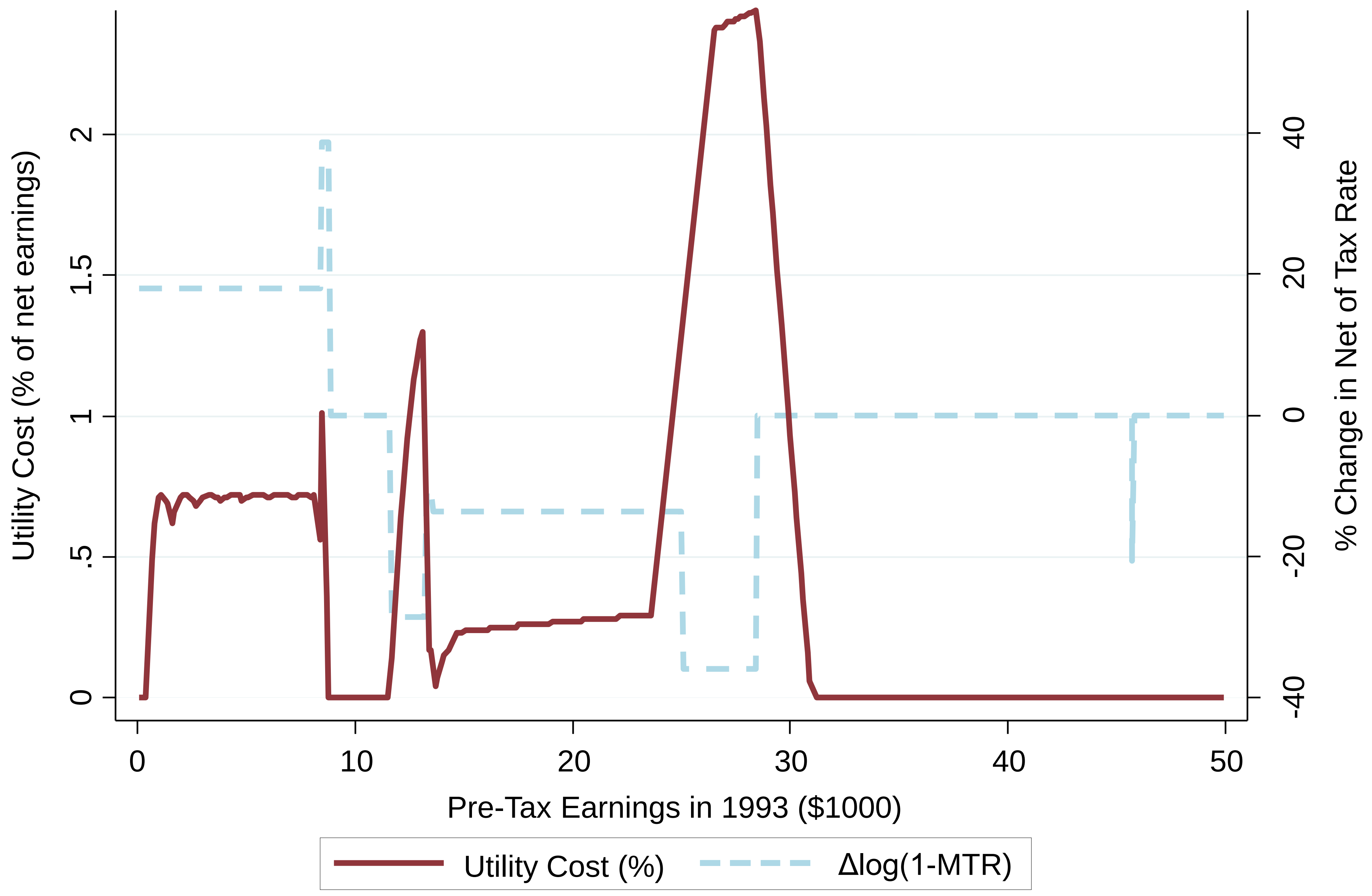


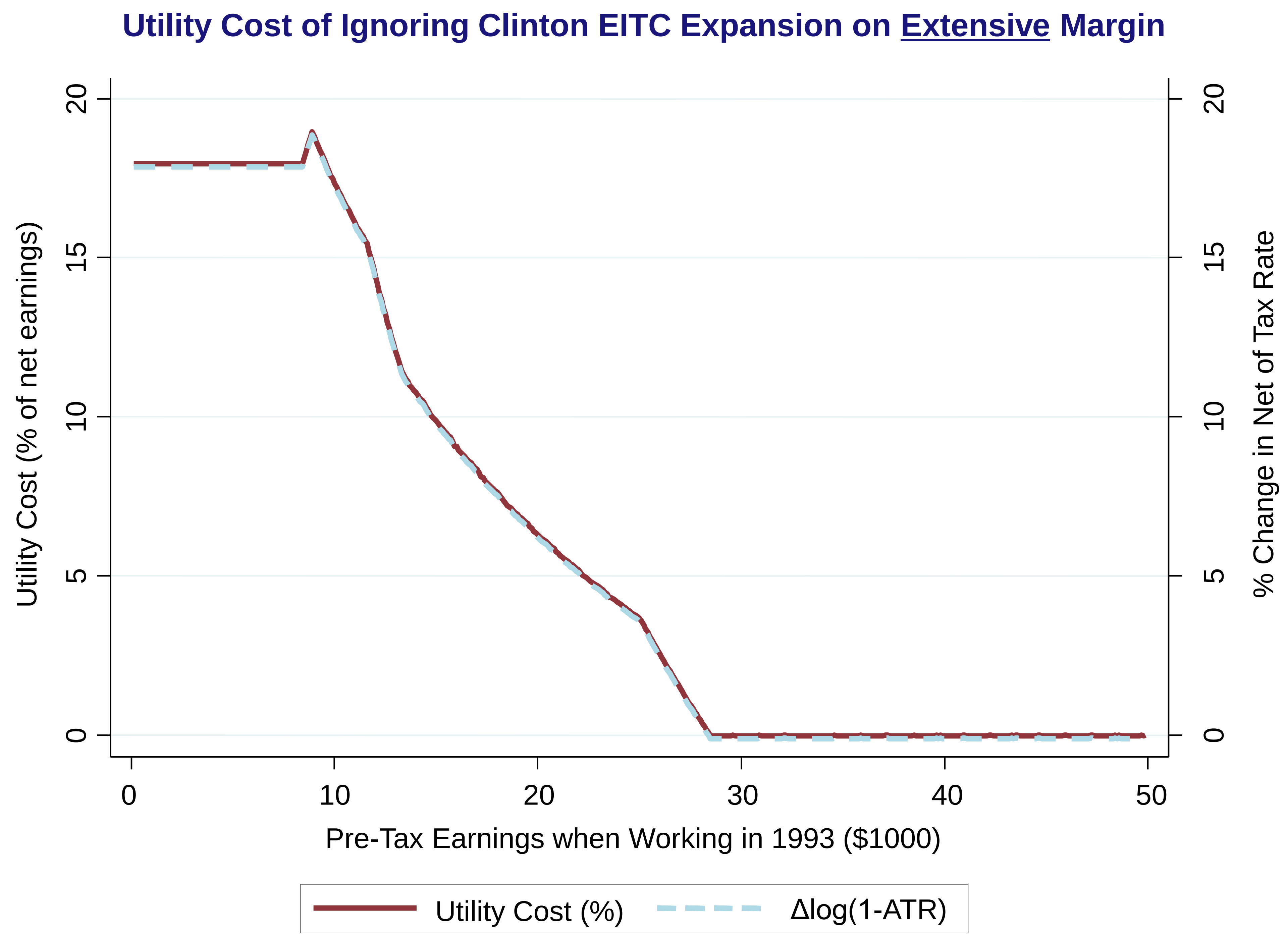
Unified Bounds on Intensive Margin Elasticity vs. Degree of Frictions
1.5
1
.5
0
$\varepsilon_{\delta-min}$=0.33
Elasticity (ε)
0%
δ_{min}= 0.5%
1%
2%
3%
4%
5%
Optimization Frictions as a Fraction of Net Earnings (δ)
Unified Bounds
95% CI Unified Bounds

Extensive Margin Elasticities

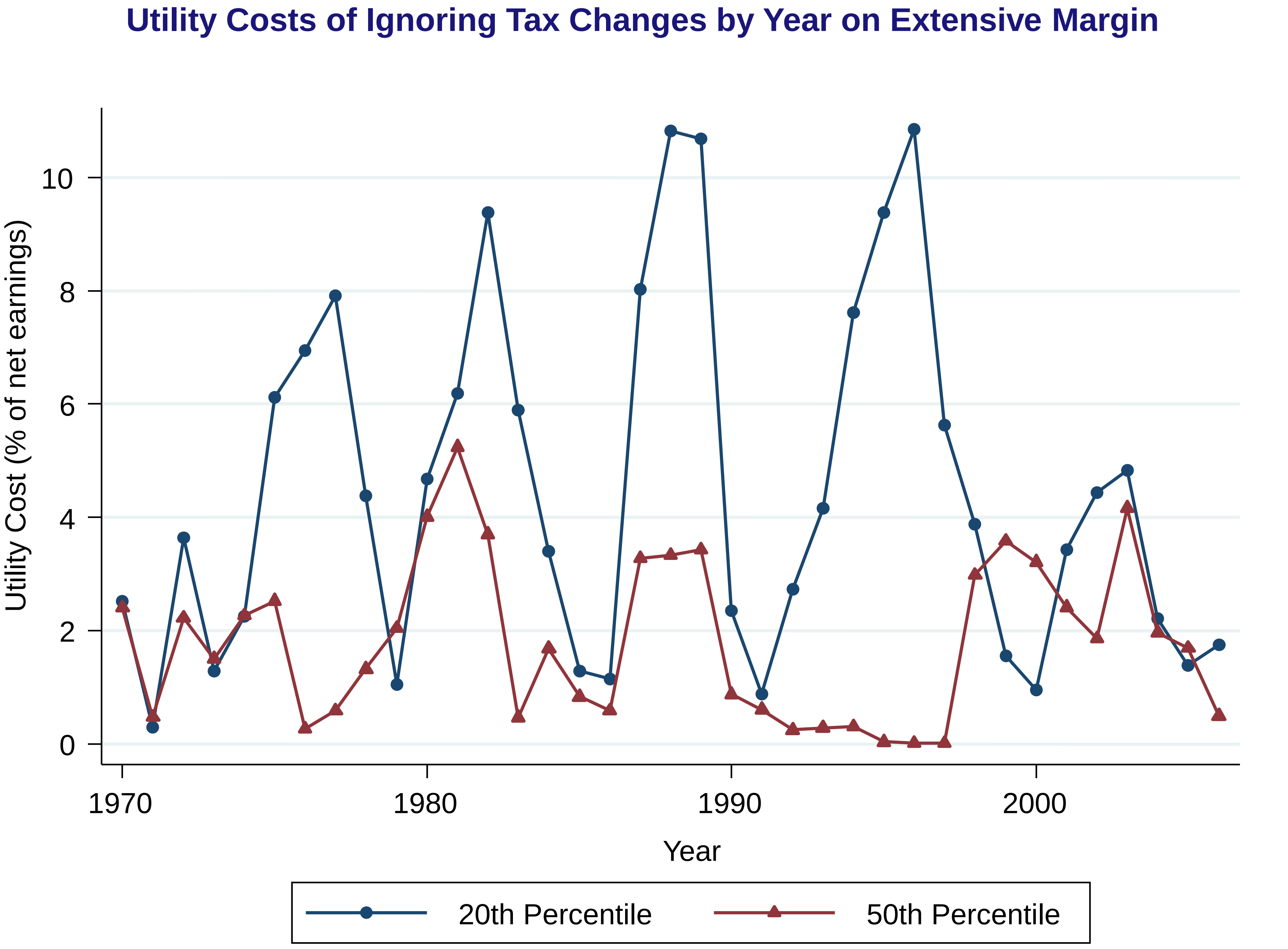
- Now consider extensive margin responses by analyzing model where workers can only choose whether to work or not
- First calculate utility costs of ignoring tax changes for marginal agent
  - This agent is just indifferent between not working and working prior to a tax change

Utility Cost of Ignoring Clinton EITC Expansion on Intensive Margin





Utility Cost of Ignoring Clinton EITC Expansion on Extensive Margin
Utility Cost (% of net earnings)
% Change in Net of Tax Rate
0
5
10
15
20
0
10
20
30
40
50
Pre-Tax Earnings when Working in 1993 ($1000)
Utility Cost (%)
Δlog(1-ATR)

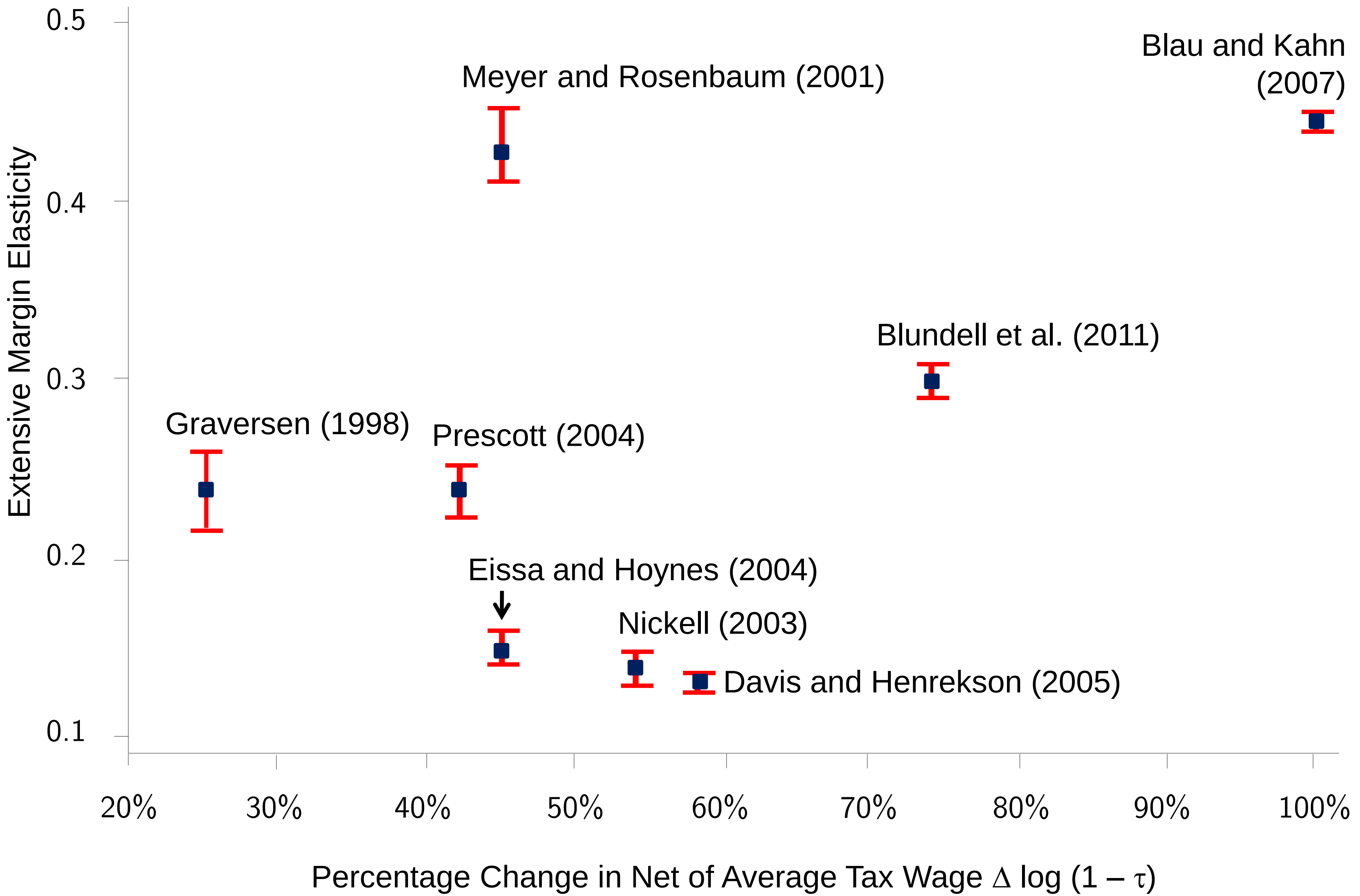


Utility Costs of Ignoring Tax Changes by Year on Extensive Margin
Utility Cost (% of net earnings)
0
2
4
6
8
10
1970
1980
1990
2000
Year
20th Percentile
50th Percentile

Bounds on Extensive-Margin Hicksian Elasticities with δ = 1% Frictions

Study (1)	Identification (2)	$\hat{\eta}$ (3)	s.e.($\hat{\eta}$) (4)	Δlog(1-τ) (5)	η_L (6)	η_U (7)
A. Quasi-Experimental Estimates						
1. Eissa and Liebman (1996)	U.S. EITC Expansions 1984-1990	0.30	0.10	0.12	0.26	0.36
2. Graversen (1998)	Denmark 1987 Tax Reform, Women	0.24	0.04	0.25	0.22	0.26
3. Meyer and Rosenbaum (2001)	U.S. Welfare Reforms 1985-1997	0.43	0.05	0.45	0.41	0.45
4. Devereux (2004)	U.S. Wage Trends 1980-1990	0.17	0.17	0.12	0.14	0.20
5. Eissa and Hoynes (2004)	U.S. EITC expansions 1984-1996	0.15	0.07	0.45	0.14	0.16
6. Liebman and Saez (2006)	U.S. Tax Reforms 1991-1997	0.15	0.30	0.17	0.13	0.17
7. Blundell et al. (2011)	U.K. Tax Reforms 1978-2007	0.30	n/a	0.74	0.29	0.31
	Mean observed elasticity	**0.25**				
B. Macro/Cross-Sectional						
8. Nickell (2003)	Cross-country Tax Variation, 1961-1992	0.14	n/a	0.54	0.13	0.15
9. Prescott (2004)	Cross-country Tax Variation, 1970-1996	0.24	0.14	0.42	0.22	0.25
10. Davis and Henrekson (2005)	Cross-country Tax Variation, 1995	0.13	0.11	0.58	0.13	0.13
11. Blau and Kahn (2007)	U.S. Wage Variation 1989-2001	0.45	0.004	1.00	0.44	0.45
	Mean observed elasticity	**0.24**				

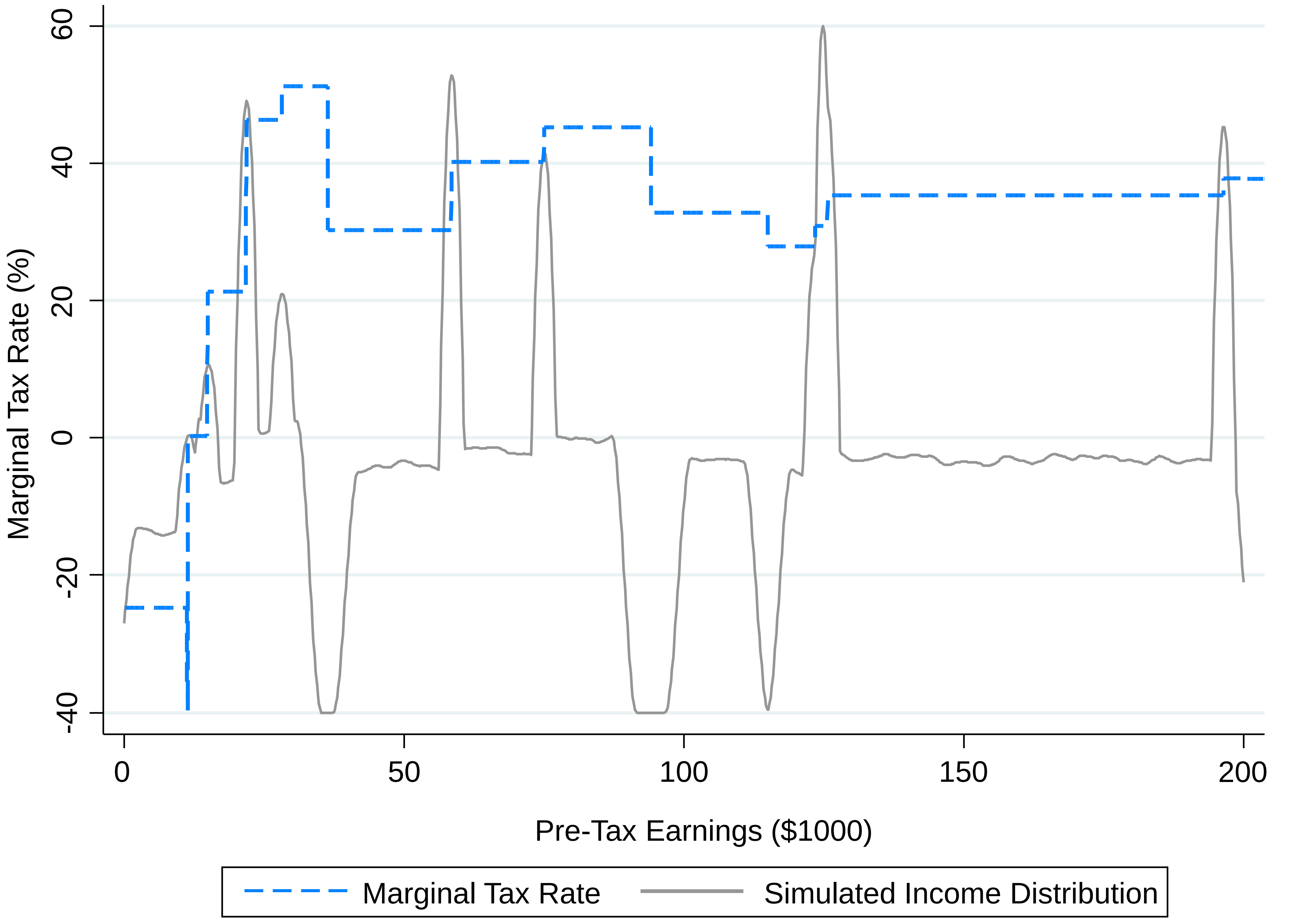
Bounds on Extensive-Margin Hicksian Elasticities with δ=1% Frictions

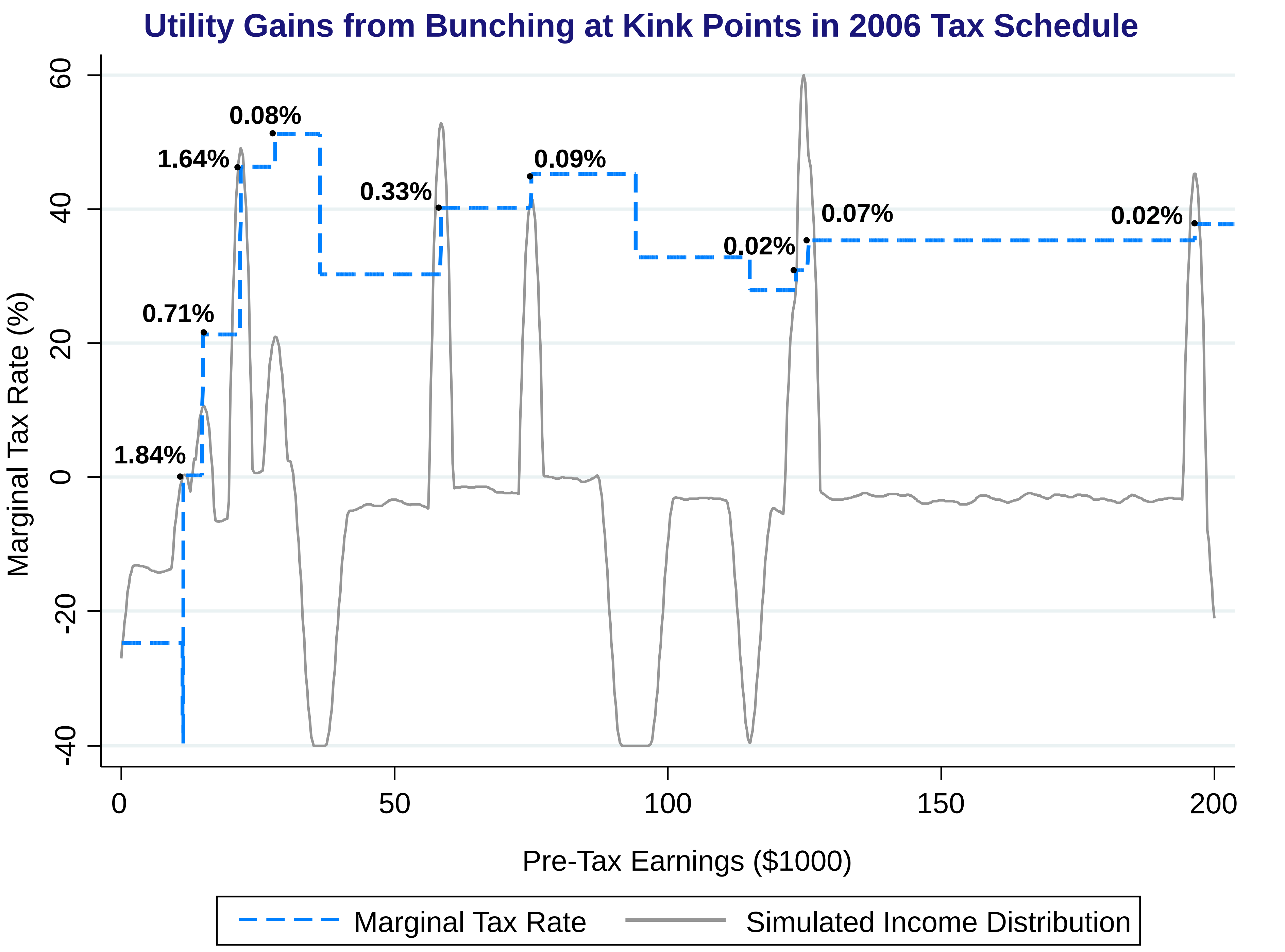


Non-Linear Budget Set Models

- NLBS models account for progressive taxation and estimate labor supply elasticities using maximum likelihood
- Problem: data rejects simple NLBS models because they predict much more bunching at kinks of tax system than seen in data
- Traditional solution: introduce optimization errors that smooth density around kink (Hausman 1981, Blomquist 1990)
- Utility cost calculations can be used to identify and bound the degree of optimization errors in NLBS models

Utility Gains from Bunching at Kink Points in 2006 Tax Schedule





Utility Gains from Bunching at Kink Points in 2006 Tax Schedule
Marginal Tax Rate (%)
Pre-Tax Earnings ($1000)
60
40
20
0
-20
-40
0
50
100
150
200
1.84%
0.71%
1.64%
0.08%
0.33%
0.09%
0.02%
0.07%
0.02%
Marginal Tax Rate
Simulated Income Distribution

Micro vs. Macro Elasticities

- Macro models calibrate elasticities in two ways
  - Variation in work hours across countries with different tax systems
  - Variation in work hours over business cycle
- Macro calibrations imply larger elasticities than micro estimates
- Can frictions explain the gap?

Micro vs. Macro Labor Supply Elasticities

		Intensive Margin	Extensive Margin
Steady State (Hicksian)	micro		
	macro		
Intertemporal Substitution (Frisch)	micro		
	macro		

Micro vs. Macro Labor Supply Elasticities

		Intensive Margin	Extensive Margin
Steady State (Hicksian)	micro	0.33	
	macro	0.33	
Intertemporal Substitution (Frisch)	micro		
	macro		

Micro: minimum-δ estimate of structural elasticity ε

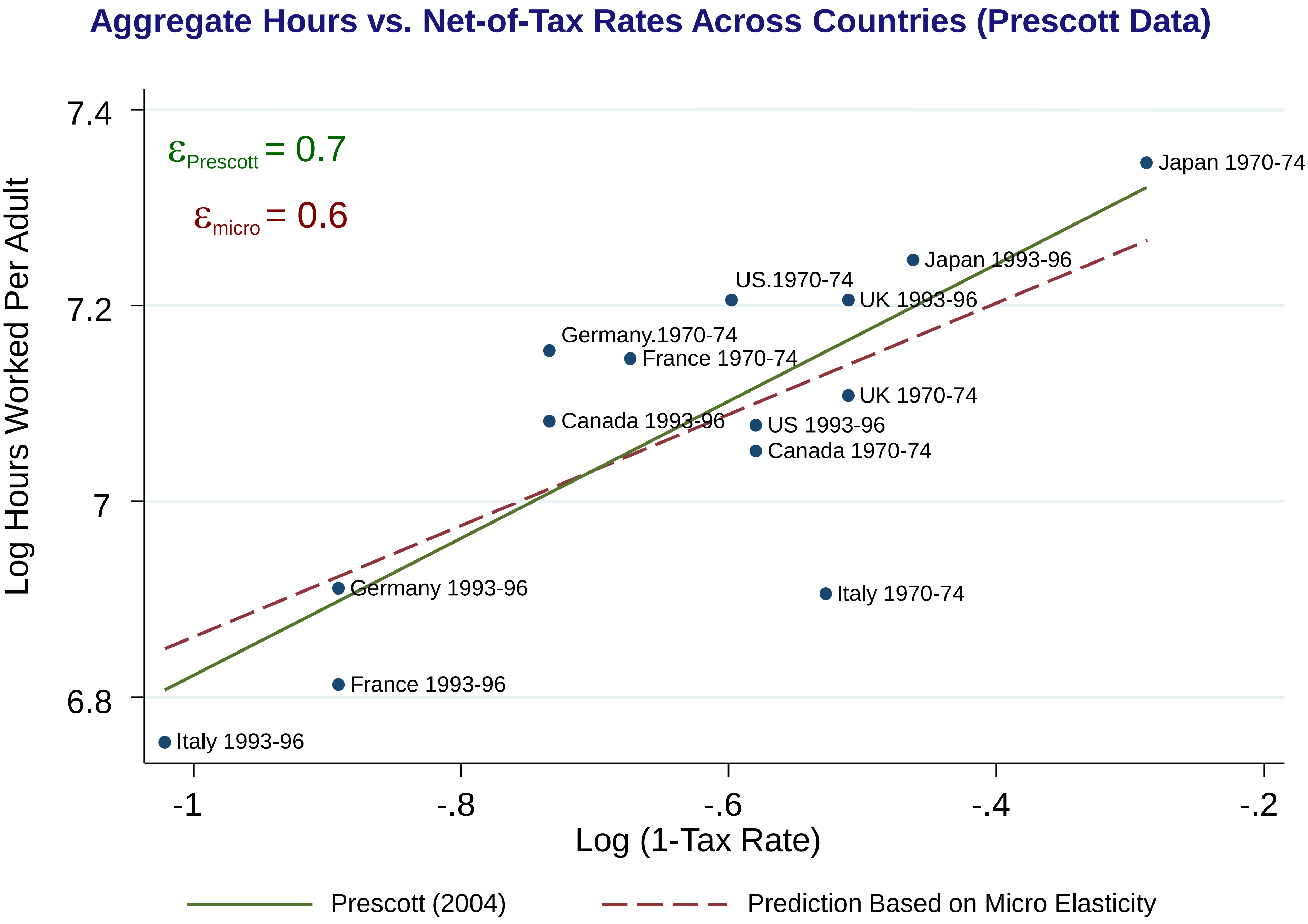
Macro: Prescott (2004), Davis and Henrekson (2005) cross-country

Micro vs. Macro Labor Supply Elasticities

		Intensive Margin	Extensive Margin
Steady State (Hicksian)	micro	0.33	0.25
	macro	0.33	0.17
Intertemporal Substitution (Frisch)	micro		
	macro		

Micro: mean estimate of η *from meta-analysis in Table 2*

Macro: Nickell (2003), Prescott (2004), Davis and Henrekson (2005)



Aggregate Hours vs. Net-of-Tax Rates Across Countries (Prescott Data)
$\varepsilon_{Prescott} = 0.7$
$\varepsilon_{micro} = 0.6$
Log Hours Worked Per Adult
7.4
7.2
7
6.8
Japan 1970-74
Japan 1993-96
US.1970-74
UK 1993-96
Germany.1970-74
France 1970-74
UK 1970-74
Canada 1993-96
US 1993-96
Canada 1970-74
Germany 1993-96
Italy 1970-74
France 1993-96
Italy 1993-96
-1
-.8
-.6
-.4
-.2
Log (1-Tax Rate)
Prescott (2004)
Prediction Based on Micro Elasticity

Frisch Elasticities Implied by Hicksian Elasticity of ε = 0.33

Income Effect: -*d*[*wl**]/*dY*

		0.00	0.11	0.22	0.33	0.44	0.55	0.66
	0.00	0.33	0.33	0.33	0.33	0.33	0.33	0.33
	0.20	0.33	0.34	0.35	0.36	0.38	0.41	0.44
	0.40	0.33	0.34	0.36	0.39	0.43	0.49	0.55
EIS	**0.60**	0.33	0.34	0.37	0.42	0.48	0.56	0.66
(ρ)	**0.80**	0.33	0.35	0.38	0.44	0.53	0.64	0.77
	1.00	0.33	0.35	0.39	**0.47**	0.58	0.71	0.88
	1.20	0.33	0.35	0.41	0.50	0.63	0.79	0.99
	1.40	0.33	0.35	0.42	0.53	0.67	0.87	1.10

Micro vs. Macro Labor Supply Elasticities

		Intensive Margin	Extensive Margin
Steady State (Hicksian)	micro	0.33	0.25
	macro	0.33	0.17
Intertemporal Substitution (Frisch)	micro	0.47	
	macro	0.54	

Micro: bound on structural Frisch elasticity

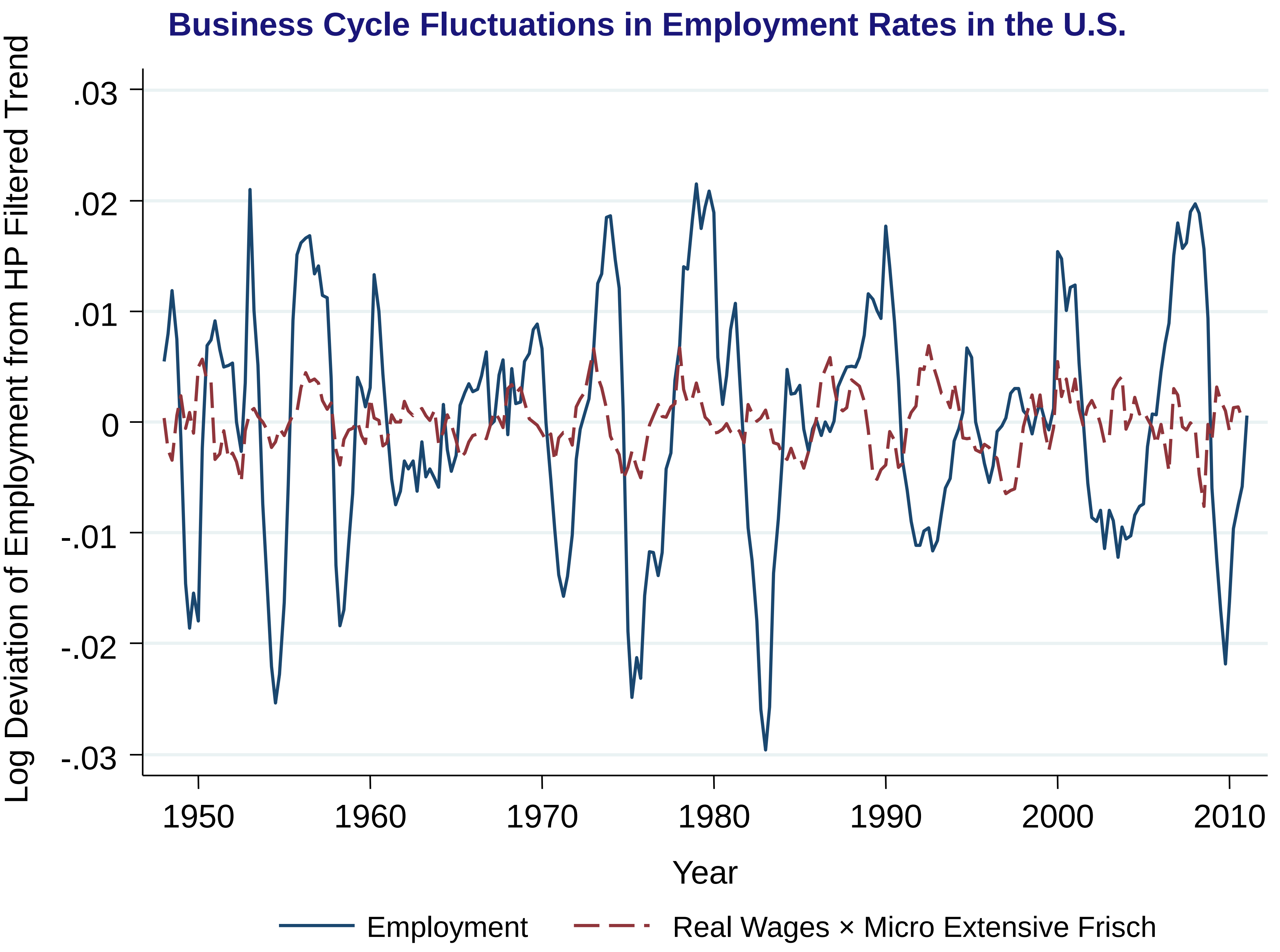
Macro: fluctuations in hours over bus. cycle (Chetty et al. 2011 based on Heckman 1984, Cho and Cooley 1994, Hall 2009)

Micro vs. Macro Labor Supply Elasticities

		Intensive Margin	Extensive Margin
Steady State (Hicksian)	micro	0.33	0.25
	macro	0.33	0.17
Intertemporal Substitution (Frisch)	micro	0.47	0.28
	macro	0.54	2.31

Micro: meta analysis in Chetty et al. (2011)

Macro: fluctuation in employment rates (Chetty et al. 2011 based on Cho and Cooley 1994, King and Rebelo 1999, Smets and Wouters 2007)


Business Cycle Fluctuations in Employment Rates in the U.S.
Log Deviation of Employment from HP Filtered Trend
.03
.02
.01
0
-.01
-.02
-.03
1950
1960
1970
1980
1990
2000
2010
Year
Employment
Real Wages × Micro Extensive Frisch

Micro vs. Macro Labor Supply Elasticities

		Intensive Margin	Extensive Margin
Steady State (Hicksian)	micro	0.33	0.25
	macro	0.33	0.17
Intertemporal Substitution (Frisch)	micro	0.47	0.28
	macro	0.54	2.31

- Indivisible labor + frictions reconcile micro and macro steady-state elasticities

- But large extensive Frisch elasticity is inconsistent with micro evidence even with frictions

Other Applications

- Bounds can be applied to estimate other structural parameters and assess which debates are economically significant
  - Marginal propensity of consumption
  - Value of a Statistical Life
  - Effects of minimum wages on employment